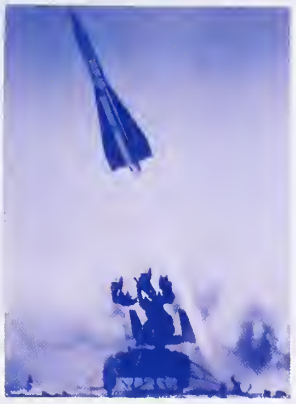

MISSILES

WEAPONS

AIR MOBILITY

MOBILITY EQUIPMENT

ELECTRONICS & COMMUNICATION

TANKS & AUTOMOTIVE

MUNITIONS

U.S. ARMY MATERIEL COMMAND

Headquarters Moves
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ARMY RESEARCH AND DEVELOPMENT

JANUARY—FEBRUARY 1973

SPEAKING ON . . .

The Case for U.S. Leadership in Technology

Assistant Secretary of the Army (R&D) Robert L. Johnson, in addressing the Dallas (Tex.) Chapter of the Association of the United States Army and the Central Florida Section of the American Institute of Aeronautics and Astronautics, in December, linked continued technological leadership to Americans' exercise of "Life, Liberty and the pursuit of Happiness."

Robert L. Johnson

★ ★ ★

On the 4th of July 1776, the Continental Congress adopted the Declaration of Independence, and since that date, our form of government has been based upon the principle that all of us have "certain unalienable rights, that among these are Life, Liberty and the pursuit of Happiness."

Tonight I propose to discuss the importance of technology in the achieving of these rights—Life, Liberty and the pursuit of Happiness—and to show why I believe the U.S. must continue to be a leader in technology.

All of us recognize that technology has changed our lives, and we expect other changes in the future as more technological advances are made. Much recent questioning has centered, however, upon whether these changes are for the good or for the bad and, hence, whether we should be as avid in our support of technology as we have in the past. I believe that by considering the interaction of technology with our basic individual rights of Life, Liberty and the pursuit of Happiness, we can gain a reasoned insight into a proper approach.

The Right of "Life." History, past and present, has shown that of these three items Life is the most cherished; and that, given a choice, most people will endure great mental and physical hardships so long as there is any hope of living. Therefore, it is only natural that everyone is motivated toward attaining a better life for himself and his family. Man has constantly tried to improve his lot over the years.

Historians note that most significant changes in our civilization had as their starting points key scientific or technological discoveries. They speak of the Bronze Age, the Iron Age, the Industrial Revolution, etc. In Texas I'm sure you recognize the "Oil Age," which changed your way of life.

As our population has increased, we have become more dependent upon technology to help feed, clothe, house, move people and to distribute materiel. The "Green Revolution," which permits us to produce enough food to feed everyone in the United States, would not have been possible without the new fertilizers, machinery, and other equipment developed in the last 25 years.

New transportation, preservation and distribution procedures and equipment, made possible by recent technological advances, now allow us to have a better diet and a great variety of foods every day of the year. Some of you probably remember when bananas and oranges, as well as many other foods, were available only for a few weeks each year—and then often they were of poor quality and too expensive for many to afford.

Today most of us do not recall that once chicken was so scarce it was served only on Sunday or special occasions. I was in college before I realized that turkeys grew all year long and didn't "mature" just at Thanksgiving!

Life expectancy of this audience is greater than that of our ancestors. This is due in part to a better diet, better housing, better sanitation, and many other improvements made possible by technological advances.

Advances of equal importance have been made with health care. Everyone over 50 present knows he will be more comfortable in the years ahead, and can expect to live longer than his parents because Pacemakers for heart patients, new diagnostic equipment for early detection of diseases, surgery by laser, and medicines are available in quantity at a reasonable cost.

The drudgery of housework—cooking, washing dishes, washing and ironing clothes, housecleaning and rearing a large family—enslaved wives for centuries. Today technology makes it possible for a housewife to experience these, or not, as she chooses.

Since man does not live by bread alone, what has technology done to help with the nonmaterial aspects of his life? Modern transportation and communication systems have opened up new opportunities for individual intellectual improvement. Today it is possible to visit most places of historical or cultural interest, and to visualize events with far more comprehension and appreciation than one gains from reading about them in books.

Technology also makes it possible for all of us to accumulate a library at a reasonable price, and makes available to us the contents of any book in any library in the United States. If President Lincoln were to give his Gettysburg Address today, it could be viewed by millions on TV rather than be limited to the few hundreds who could travel by train and horse to the site.

Even though there are a few in this country who say we should discard all modern technological advances, I believe that not only is it impossible to reverse the trend, but that it is preferred by the majority of any country—witness the desire of the citizens of every underdeveloped or subjugated country for more of the services and consumer goods just discussed.

However, a word of caution should be sounded here. While technology can satisfy many of our material wants, and make life easier, it also helps us spoil our environment at an accelerated rate when we become greedy or thoughtless.

From these facts, I draw the conclusion that technology has been and will continue to be an invaluable asset to our right of Life. May I defer until later the question of why the United States should be a leader in technology oriented to Life.

The Right of "Liberty." Liberty to the individual is almost entirely dependent upon whether the nation of which he is a part is free from domination by other nations—and, in the end, freedom from such domination is dependent upon the nation's ability to defend itself.

But defense, in this sense, means more than ability to repel attack. It also means deterring attack through proper foreign policy and the ability to prevent domination through economic pressures. Let us first examine the interaction of defense, deterrence and foreign policy.

As part of our foreign policy, we must have Armed Forces that can meet the commitments that our civilian political leaders make. I cite a very recent example in the modern scene—the Soviet missile installations in Cuba.

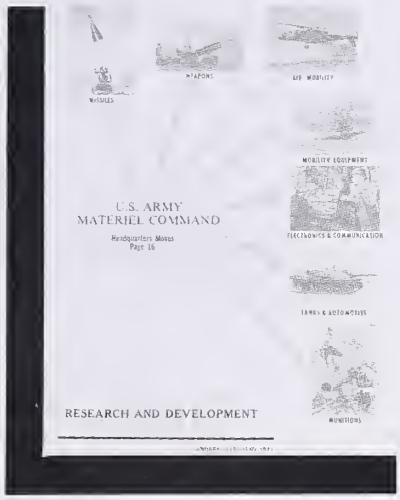
We took a very firm stand in Cuba. President Kennedy made a very clear foreign policy pronouncement as to how we looked at the missiles being installed there. Now I hope you and I realize that unless he had the wherewithal of the Armed Forces to back up that statement, it would have had a hollow ring, and maybe a very different end result.

In a more general sense, during the last 2,000 years of recorded history, there has been armed conflict 80 percent of the time. Since we can detect no basic change in man's willingness to fight to preserve what he has or what he thinks he should have, it is probable that the requirement for strong conventional Armed Forces will continue.

Application of technology to provide high-caliber Armed Forces has not, however, always been accomplished in this country. During World War I, the United States had no military technological base, so we were dependent upon our Allies for the latest designs. The French 75mm artillery gun, British and French aircraft, and British tanks are a few examples that illustrate this dependence.

When World War II started, we were in much the same con-

(Continued on page 19)



RESEARCH AND DEVELOPMENT

Vol. 14, No. I **January-February 1973**

ABOUT THE COVER . . .

AMC major subordinate commands include seven commodity commands responsible for research, development, production, and procurement in the assigned commodity areas depicted on the front cover. AMC also includes one test and evaluation command and a logistics support-type command. The back cover shows the new 13-story building that will be occupied by about 2,600 AMC headquarters employes in a time-phased move expected to be completed by Mar. 1. AMC employs about 25,000 scientists, engineers and technologists in all its activities.

Editor . . . . . Clarence T. Smith
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FEATURES

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Selective Scanner . . .

Computer Tests 60mm Mortar Design Concepts

Conceptual design changes in a weapon system can now be test "fired" mathematically at the U.S. Army's Watervliet (N.Y.) Arsenal by using a highly sophisticated computer technique developed for NASA's Apollo moon exploration program.

Developed at a cost of more than $5 million, the NASA computer technique is being used for analyses of a 60mm mortar system. Chief advantage of the computerization is a reduction in requirements for the often costly preliminary field test "try it and see" experimentation.

Additionally, the NASA program relieves the designer from communicating with the computer in strictly mathematical terms. Weapon size and shape are simply described along with forces applied to the weapon as it is fired. Through this "modeled and fired" technique, design changes can be examined quickly.

Dr. Thomas Simkins, a mechanist in the arsenal's Applied Mathematics and Mechanics Laboratory, was responsible for adapting the NASA program to weapons systems design. He is currently comparing actual weapon firing performance with that predicted by simulated firing on the computer model.

WATERVLIET ARSENAL researchers (1. to r.) Dr. Thomas Simkins, Gary Woods and Maurice Scavullo with 60mm mortar.

Instant 'Stones' Studied for Minefield Passage

Formed-in-place chemical foam "stepping stones" to provide a safe path through minefields is a concept being investigated by the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va.

Sprayed on the ground ahead of an operator carrying a portable backpack unit, the special foam forms and hardens almost instantly into pads that allow the operator to cross the minefield as he sprays the path ahead.

The portable pack, which weighs 60 pounds, carries enough foam to create 30 to 35 "stones." This is enough to provide a safe path through a 100 foot-long minefield. The polyurethane foam pads are 17 inches in diameter and 4 inches thick. To date, only commercially available foam has been used in this initial conceptual investigation.

The experimental minefield bridging concept was developed by Martin Marietta Aerospace under contract.

Watervliet Develops 81mm Disposable Launcher

Watervliet (N.Y) Arsenal reports successful testing on an 81mm recoilless one-shot weapon system with a lightweight disposable Fiberglas launcher.

Designed, developed and fabricated at the arsenal, the weapon reportedly has proved its effectiveness over existing recoilless systems, particularly its capability to destroy an enemy tank or bunker.

Dr. Giuliano D'Andrea (left), head of the Organic Composites Group, and Robert Cullinan, research chemist, are shown with the disposable, fiberglass, 81mm launcher designed at Watervliet Arsenal.

When ammunition and ballistics data on the 81mm XM73 became available, the arsenal was tasked for the design of a lightweight launcher compatible with ballistics involved. Responsibility for design and development of the launch tube and the mandrels upon which the tube was formed was assigned to Dr. Giuliano D'Andrea, head of the Organic Composites Group.

Tasks of this nature normally require 12 to 18 months, but the Army's in-house R&D team accomplished it in seven months. While Watervliet was responsible for over-all system management, ammunition and fire control were developed respectively by Picatinny Arsenal, Dover, N.J., and Frankford Arsenal, Philadelphia.

Additional tests of the system are being scheduled for presentation before top Department of the Army officials.

Satellite Photos Being Used in Dam Inspection

Photographs from the NASA Earth Resources Technology Satellite (ERTS) will be used as one means of locating dams in the United States for a national inspection program.

A guide to the use of ERTS-1 imagery to pinpoint major dams in the United States has been prepared by Dr. Harlan McKim, Thomas Marlar and Dr. Duwayne Anderson of the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H.

In the program conducted by the U.S. Army Corps of Engineers, all dams which are 25 feet or more in height or have a water-impounding capacity of 50 acre-feet or more will be inspected. Technical and visual inspection will be made to determine the adequacy and safety of these dams.

The ERTS-1 imagery defines water bodies larger than six acres or 500 feet in diameter. Dams on streams can be identified by an abrupt change in stream width. A linear delineation on a water body is also a reliable indicator of a dam, particularly when it is inconsistent with a normal drainage pattern which appears in the image. In addition, the imagery can be used to determine relative water depth and gross sedimentation patterns.

The ERTS-1 satellite was launched July 23, 1972, in a 570-mile near-polar orbit. It takes repetitive photographs on any given section of the earth every 18 days. For the current study, two of the four bands transmitted by a multispectral scanner are being utilized. The first (800–1100mu.) is used to locate water bodies and the second (600–700 mu.) is used to determine drainage patterns and mapping.

Other ERTS studies being conducted by USACRREL for NASA include investigation of arctic and subarctic environments in Alaska.

Army, Navy Cooperate in Moon Radiation Study

In a display af multiple caoperation, the U.S. Naval Ordance Missile Test Facility's Racket Bronch used the U.S. Army's White Sands Missile Ronge (WSMR) to lounch scientific experiments pravided by the University af Colorada and Jahns Hopkins University, Baltimare, Md.

The purpose af the operotion was to conduct the experiments simultaneously with observatians being made by the Apolla 17 astronauts orbiting the moon.

The University af Colorodo experiment was designed ta exomine the Fraunhafer lines in the ultraviolet range of the sun's spectrum to determine how fast the otoms ore maving in the solar otmosphere. The simultaneaus Apollo experiment involved observing the night side af the moon far rodiatian emitted by otams just abave the maon's surfoce.

The Johns Hopkins experiment exomined not only direct radiatian from the sun but also reflected light from otoms in the earth's strotosphere. Other equipment in the 400-pound Johns Hopkins instrument mode direct measurements of the earth's ionasphere. Praf. William Fastie was in chorge of the over-oll Johns Hopkins experiment, which he monitored from the NASA control center ot Houston, Tex.

STRATCOM Expands Telecommunications Support

Exploration af new hordwore and software concepts intended to reduce writer ta reader time is the mission of the recently apened U.S. Army Telecommunicatians Software Support Center (SSC), U.S. Army Strotegic Communicotions Command (STRATCOM), Fort Huochuca, Ariz.

The center will be operated by the Communicatians Electronics Engineering Instollotion Agency, Telecommunications Automotion Directarote. Responsibilities ossigned to the directarate include designing, documenting, develaping and maintoining stondordized camputer program systems for Army telecommunicotions centers and terminals.

Estoblishment of the center is part of o continuing effort to provide automotion for all Army telecommunications centers in the 1980s. Currently, the SSC provides saftware support ta over 40 automated telecommunications centers and terminals throughout the world. Creation of an additianal 47 sites is scheduled.

HDL Uses Fiber Optics for Oscilloscope Pulses

A means of using fiber optics to trigger an oscilloscope designed ta accept external triggering pulses has been developed by Rudolph J. Prochazko, on engineer at the U.S. Army's Harry Diamand Labaratories (HDL).

Such ascilloscopes ore narmally designed to accept the pulse by meons of coaxial cable. In o strong electromagnetic environment, this method is inadequate. Prochazka's modificatian is simple, inexpensive, ond unrelated to the other circuitry of the oscillascape.

The system alteration consists of substituting o fiber optic cable for the caoxiol ond terminating it at a photodetectar inside the ascilloscope, thereby avoiding the electromagnetic interference. The circuitry uses a Motorolo MRD-500 photodetector maunted in a Tektronix oscillascope with a one megahm trigger input impedence. Trigger response time is 10 nano-seconds.

Sprint Intercepts ICBM in High-Altitude Tests

A Sprint missile has successfully intercepted a simulated Intercantinental Bollistic Missile (ICBM) over the Kwojalein Atall in the Pacific in tests conducted by Kwojalein Missile Range.

Lounched from a remate site under the cantrol of o research and develapment Missile Site Radar (MSR), the Sprint was tested at White Sonds Missile Range, N. Mex., until August 1971.

Purpase of the recent test was ta examine the capability of the MSR and the ability of its data pracessar to launch and guide a Sprint withaut on explosive warhead fram a launch site to a short-range, high-altitude intercept.

This test wos the 21st in the second series, which began in 1971. Current tests ore designed to evaluate the integrated system using more complex intercept equipment. Nineteen tests in the current series hove been successful.

STRATCOM Eyes Digital Transmission System

Digital tronsmission in line-of-sight communicatians averseos may replace analag (audio) transmission if o Defense Communicotians Agency-sponsored study finds it feosible.

Tasked to investigote the cancept feasibility is the U.S. Army Strotegic Communicatians Command (STRATCOM), Fart Huochuco, Ariz., where the test bed far the system—two terminols, a repeater station and peripherol equipment—will be located.

Digitol transmission through a microwove network minimizes the distortian thot tends to accumulate on analog circuits. Other advontages include transmission chonnel sharing of voice, message and dato traffic.

A similor program far tropospheric-scatter tronsmission is scheduled to be investigoted, a STRATCOM spakesman said.

Coordinating the test and evaluotion study is STRATCOM's Office of the Assistant Chief of Stoff far Force Development. Other participants are STRATCOM's Communications Electronics Engineering Installation Agency, and the Army Electronic Praving Ground, both located ot Fort Huachuco.

STRATCOM is the principol monager of Army nontacticol communications, responsible for engineering, instolling, operoting and maintaining ossigned portions of the Defense Communications System. As part af its mission, the worldwide commond provides substantial communicotians support to the White House and several U.S. Government ogencies.

Army Vaccine Utilized for Meningitis Study

Voccine furnished by Wolter Reed Army Institute af Research (WRAIR), Washington, D.C., is being used in o study of the potency of the vaccine againat Group C meningitis in schoolchildren in selected grades.

Finonced by the Notionol Institute for Allergies and Infectiaus Diseases, U.S. Institutes of Health, the study in Donbury, Cann., is being conducted by three doctors farmerly with WRAIR. Drs. Irving Goldschneider and Emil Gotschlich were involved in the research that produced the vaccine. Dr. Martha Lepow is now working with them.

A similor earlier study by this team was financed in port by the U.S. Army Medical Research and Development Commond. The infants were aged 3 months to 1 year and the children from 1 to 9 years. The vaccines were found to be safe in both groups but more effective in producing ontibodies in older children.

An article in the January 1970 issue af the *Army Research and Development Newsmagazine*, pages 32–33, describes how the vaccine wos developed at WRAIR. The coauthors are Dr. Malcolm S. Artenstein, chief of the WRAIR Department of Bacterial Diseoses, and COL Edward L. Buescher, former director and commandant of WRAIR.

Army R&D Newsmagazine Becomes Bimonthly

With this edition, the *Army Research and Develapment Newsmagazine* becames a bimanthly instead of a monthly publication, in accordance with o recommendation af the Department of the Army Periodical Authorization Ad Hoc Committee and an extensive study af Department of Defense periodicols.

The number of pages in eoch edition is reduced from 52 to 36. Effecting a totol reduction of 66 percent af the page space formerly ovailable ta serve the Army R&D community, these changes will impose stringent requirements on selection of moteriol. Effective utilization af space will rote tap priority.

Much as the liberal use of white space, larger type faces and modern typagraphical design may enhance eye appeal of a periadical—as was put into practice during the past year in this publication—the editors must now recognize that maximum news coverage to serve the Army R&D cammunity is essential.

Picatinny Shaves It Close . . .

Engineers Achieve Precise Tolerance In Producing Shaped-Charge Liners

Machining a copper cone to a tolerance of ±0.0002 inch is high-precision work that is now routine to engineers at Picatinny Arsenal, Dover, N.J.

To maintain this tolerance in the production of shaped-charge liners—which are mounted inside a shell or warhead—engineers have developed a way to machine the inside diameter and the outside diameter at the same time and at the same point on the workpiece wall.

Meeting specifications such as these, in which the consistency of wall thickness affects performance and accuracy, is one of those production engineering and development jobs in which the arsenal specializes.

Ordinarily, this job would be placed with an outside supplier when it reached production quantities; however, the arsenal is producing a limited amount of the cones in-house because of the special machine used and the machining process developed to meet the critical tolerances.

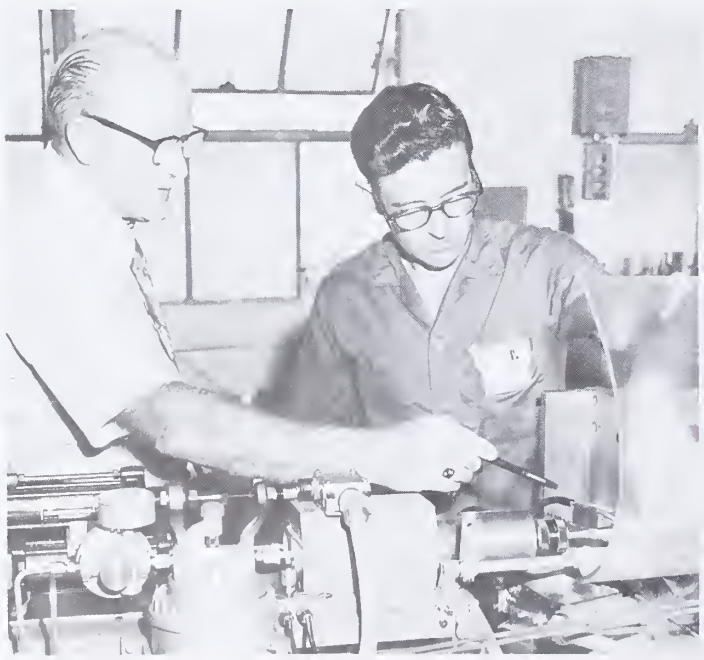
During the production development phase, Robert Findlay, a production engineer in the Ammunition Development and Engineering Directorate, investigated simultaneous inside and outside machining to meet the required tolerances.

A machine, built by MB Associates of San Ramon, Calif., was modified and proved capable of producing the cones within desired tolerances.

The machine is a center-drive lathe with three slides, two of them mounted on a third main slide that is aligned with the cone-taper angle (anything up to 60°). The two smaller slides position diamond tools, one on each flank of the workpiece, and retract under automatic control to clear the work and allow unloading and loading.

The headstock is like a center-drive unit. It is open in the middle to clear the inside diameter toolslide and tool. Instead of a chuck, which could easily distort the thin-wall cone, there is a precision-machined circular rotating holder that fits the small flange on the cone, which is also precision machined.

The cone workpiece is held against the recess in the circular drive plate by an air-hydraulic tailstock pusher with a shaped foot that presses the cone and allows free rotation. Friction is sufficient to hold the workpiece as the headstock rotates, partly because of a close fit and partly because the diamond tools take a very light cut which is a finish machining operation on the cones.



PICATINNY ARSENAL production engineer Robert Findlay and Roderick Muck, a machine tool job setter, check copper cone during machining process developed to meet critical tolerances in arsenal's production of shaped-charge ammunition liners.

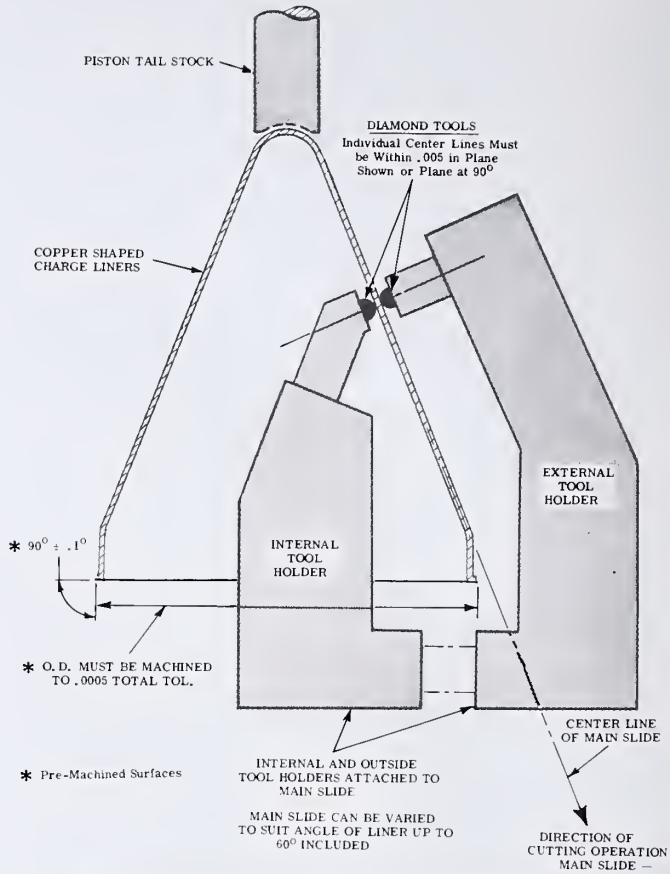


Fig. 1. Schematic Layout—Liner Finishing Machine

Prior to this operation, the cone has been deep-drawn through seven stages and then ironed to contour in three stages, so that it is about half-hard when machined (a preferred condition), and only about 0.005 inch remains to be turned from the wall, which, on 3-inch-diameter cones, is 0.039 inch thick.

The normal machine cycle, controlled through an electrical panel and relays, is to load the raw part manually, trip the switch that positions the tailstock piston, and then rapid-advance the tools to within 0.015 inch of cutting position. From which point both tools advance slowly to cutting position. The cut starts at the outer end (tip) of the cone and continues rearward toward the pre-machined flange. Coolant startup and backoff at the end of the stroke are automatic.

Using a 5-horsepower motor and spindle speeds ranging from 1800 to 5600 rpm, the machine maintains a constant cutting speed of 800 square feet per minute as the outside work diameter changes along the cone taper.

Several cone sizes, up to 4½ inches, can be machined with virtually the same tooling, with only a change of the holder and tool stop positions. At regular cutting speeds, the cycle time for cutting is from 30 to 90 seconds.

When the diamond tools are new or newly reground, a surface finish of 4 millionths of an inch usually results. The requirement is 32 millionths of an inch, but even when the tools are changed after appreciable wear, this surface finish is more than attained.

The holding of tight tolerances on concentricity and thickness of the cones during manufacture also reflects improvement in the performance of the end item.

Programed Logic for Automated Training Operations Moves Into Phase 4

PLATO (Programed Logic for Automated Training Operations), a project of the Computer-based Education Research Laboratory of the University of Illinois at Urbana-Champaign for more than a decade, is entering a new phase.

PLATO IV will undertake to train and instruct men and women in an Advanced Research Project Agency (ARPA) joint-Services program using some 60 terminals. Each Service will have its own terminals with access to the central system. The program will develop and exchange instructional material for Service schools and a number of selected community colleges, and it will do research and development work on PLATO hardware and software.

Each Service and all of the community colleges will participate in PLATO IV individually, although instructional material will be exchanged.

Two of the Army's terminals will be installed at the Human Resources Research Organization (HumRRO) in Alexandria, Va., to provide a tie-in with existing Army research and development in computer-administered instruction (CAI). This is an outgrowth of programs such as Project IMPACT (see *Army R&D Newsmagazine,* February 1969 and March-April 1970 issues.)

Fourteen PLATO-IV terminals allotted to the Army will be placed in a center at the U.S. Army Ordnance Center and School, Aberdeen Proving Ground, Md. There the central vehicle for the test and evaluation of the system will be the machinist's course, MOS 44E20. The remaining four terminals will be installed at the U.S. Army Signal Center and School, Fort Monmouth, N.J.

One key feature of PLATO IV is that the entire central computer, which may eventually be able to handle up to 4,000 remote terminals over a large geographical area, is located in one place—Urbana. The terminals will be clustered at learning centers, the first of which will probably be built at Chanute AFB, Ill.

The central concentration of PLATO's circuitry combined with flexibility allow it to operate at an estimated $1.50 per student-contact hour when student consoles are assembled from pilot production components. When production becomes routine, that cost is expected to drop to 50 cents or less.

Another key feature of PLATO IV is that the educator can use it to test and evaluate students and to handle student records as well as to teach. Every student console can also be used for authoring, and therefore instructors can work on lesson materials from classroom, office, or laboratory.

A third key feature is that PLATO IV allows separation of the technical maintenance of the system, including lesson material, from the management of the educational system itself.

The PLATO IV program calls for installation of 20 student consoles in its 3 Service systems by March-April 1973, 20 more by June, and the remaining 20 by August. The University of Illinois will provide operation and maintenance of each system and will designate a program liaison officer to coordinate educational plans through the program director at Urbana-Champaign.

The first year of PLATO IV will concentrate on systems research, although there will also be work on software development and associated test materials in the interest of on-line evaluation routines for use at the Armed Forces centers and community colleges.

One of the features of PLATO IV is an octaphase modulation system—similar to the technique whereby two stereo channels are broadcast over one FM station—whereby 8 PLATO IV-type consoles could be operated over the same voice-grade direct dial telephone circuit. Obviously such a system would result in an eightfold savings in communication expense.

Another feature of PLATO IV is the graphics terminal, which is based on a 512 x 512-line plasma display. The plasma display is basically a glass sandwich within which any of more than 262,000 tiny gas crossover points can be turned on or off.

When a crossover point is on, it glows like a neon lamp. The resulting display can be much easier to read than can a cathode ray tube display because every part of the image is either on or off; there are no grays.

In addition to the plasma display, the glass sandwich can be used as a viewing screen for a microfiche projector, which in PLATO IV is pneumatically driven. The system can therefore project a photographic image and superimpose lines, graphs, letters, figures, or any other type of visual information upon it.

A further element of the PLATO IV graphics presentation is the finger touching input, whereby the student may answer questions by touching any area.

The TUTOR system, a special language for computer-aided instruction, is designed to facilitate and simplify the process of preparing course material.

The PLATO IV test program will run from July 1973 to June 1975, and the proposed budget for the 3-year period is $2,100,000, funded by the Advanced Research Projects Agency. Each service will contribute the facilities and personnel costs attendant to its portion of the PLATO IV evaluation.

In addition to the machinists' course, MOS 44E20, the service center at Aberdeen Proving Ground will offer PLATO IV instruction in teaching methods and other subjects as facilities permit.

The University of Illinois is not committed to any service after June 1975 but will help the Armed Forces to arrange for a smooth and economical transition to another computer system should such aid be necessary.

The Urbana-Champaign researchers envision significant improvements in follow-on PLATO systems.

The U.S. Army Signal Center and School at Fort Monmouth, N.J., has for several years been experimenting with an IBM 1500 CAI system (see *Army R&D Newsmagazine,* January 1968 issue). Analysis of Signal School results suggests that computers teach faster but just as well as conventional instruction. Students like the "private tutor" feature of CAI; they also like the idea that they can set their own pace in the course.

New USAMRDC Crest Symbolizes R&D Tradition

"Research for the Soldier" is the motto inscribed on a new crest symbolizing the tradition and worldwide mission of the U.S. Army Medical R&D Command (USAMRDC).

Designed by the Army Institute of Heraldry, the insignia will be worn on the uniform epaulets of military USAMRDC personnel.

Included on the distinctive design are entwined serpents signifying the art of medical healing. A flaming torch lights the way into the unknown, and a hexagon represents a symbol used in organic chemical formulas.

The maroon and white colors of the hexagon, the scroll and the spherical segments, are traditional colors of the Army Medical Department and provide a striking contrast to the rich gold color of the serpents, inscription, torch and emanating rays.

MG Richard R. Taylor, CG of the USAMRDC, introduced the new crest, in honor of those devoting their lives to research in preventive and curative medicine for the welfare of the soldier, during a recent unit commanders conference in Washington, D.C.

RSRA—Rotor Systems Research Aircraft

USAAMRDL, NASA Research Produces Plans for Experimental Helicopter

By Lawrence A. Perkins
Special Staff Writer

As the helicopter assumes an expanding role in special military and civilian transportation requirements, technical problems have developed that are getting priority consideration.

Military and civilian researchers have continued to delve into aerodynamic theory, aeroelastic effects, structural and mechanical concepts, and the dynamic behavior of aircraft rotors. Analysis, the experimenters' wind tunnels, rotor towers, and analytical flight simulation studies cannot, however, entirely replace flight tests for realistic demonstration or confirmation of concepts.

Until now, these tests have been accomplished at considerable expense—and frequently with minimal success—by modifying an existing vehicle or building a new one for every experimental development.

A joint study by the Army and the National Aeronautics and Space Administration (NASA) has led to the conclusion that a specially designed Rotor Systems Research Aircraft (RSRA) thoroughly instrumented, operating over a wide range of test conditions, with configuration flexibility to enable testing a variety of rotor systems is the way to break this expensive bottleneck.

The U.S. Army Air Mobility R&D Laboratory (USAAMRDL), an organization with a unique interagency relationship with NASA, jointly with the NASA Langley Research Center, is hard at work on plans for building two RSRAs.

Some of the USAAMRDL and NASA projects now under development for better helicopter performance that are candidates for RSRA adoption are a controllable twist rotor that could improve blade lift distribution in both hovering and forward flight; a variable geometry rotor that by changing the hub angle between blades could reduce noise and vibration; a variable diameter rotor that could reduce the forward drag of the rotor but retain the more efficient low disc loading while hovering; and a slowed rotor that could yield its lifting function to conventional wings in forward flight.

The design of the RSRA will rely heavily on the integration of the technical information presently available. Much of this has been gathered at the four directorates of USAAMRDL—the Eustis Directorate at Fort Eustis, Va.; the Langley Directorate at Hampton, Va.; the Lewis Directorate at Cleveland, Ohio; and the Ames Directorate at Moffett Field, Calif.

Broadly speaking, the areas of USAAMRDL R and D consideration are air-foil technology, blade geometry, landing qualities, performance, and rotor structures.

A vehicle such as the RSRA would be a flying wind tunnel replacing all of the current proof-of-concept vehicles of high cost and dubious effectiveness, and providing the flight testing that is essential to any rotor research project. Not only must the various wind tunnel and whirl tower tests and analog computer runs be verified against reality; none of the non-flying tests reveals anything about the critical matching of the aerodynamic properties of the rotor system to the vehicle body.

It is anticipated that the repeated use of the same aircraft components such as airframe, power plant, and control system for testing various rotor systems will be vastly cheaper than building an entire aircraft for every experimental rotor system.

Furthermore, using the same instrumented and calibrated aircraft under rigorous control conditions will simplify documentation of tests and provide excellent correlation between the results of tests using different experimental systems.

The main and auxiliary power plants will be off-the-shelf hardware, and—wherever possible—the other components such as power trains will also be flight-qualified. There will be a provision for fitting the RSRA with either stub or full-sized wings, and it will also accept a pair of jet pods for auxiliary propulsion.

There will be a complete force measurement system for the RSRA, and both rotor and fixed-wing control elements will be so integrated that its mode of operation can be either pure (rotor only or compound (rotor and fixed wing). There will be an adaptable transmission mount

ARMY CHIEF OF R&D LTG William C. Gribble Jr. and Deputy Assistant Secretary of the Army (R&D) Charles L. Poor listen to Robert Hosier during a recent visit to the NASA-Langley (Va.) Research Center to review the joint Army/NASA Rotor Systems Research Aircraft program. COL John C. Gilbert, Army Materiel Command, is in rear.

that will permit testing of significantly different rotor and transmission systems.

The RSRA control system will include fixed-wing aerodynamic control surfaces in addition to conventional rotor controls. Its mode will be computer-controlled fly-by-wire because computer logic should allow adaptation to the control requirements of a wide variety of rotor systems. Furthermore, it will permit rapid modification in the control authority over both the rotor and the fixed-wing systems in order to provide proper integration and the control harmony necessary in compound operation flight tests.

In order to obtain uniform measurements from the various experimental flights, the computerized RSRA control system will be capable of making preprogramed evaluation maneuvers either in regular steps or in stepless gradations. It will also have suitable backup systems to insure flight safety.

The RSRA monitoring system will measure the state of the vehicle as well as the forces and movements of the rotor, wing, and auxiliary propulsion system. The sensors will be compatible with the Langley-developed Piloted Aircraft Data System. The transmitting device will be compatible with the Langley Research Aircraft Ground Station so that there may be on-line monitoring of tests in progress as well as fast, detailed assessment of rotor and vehicle characteristics.

A variety of rotor systems with a wide range of dynamic characteristics will be flown with the RSRA, and for this reason the RSRA will be designed to adapt to these various corresponding vibratory loads. There are several techniques for attenuating the vibratory loads, ranging from simple spring-mounted transmission pads to active isolation systems. The one that will allow adaptation of the widest range of rotor systems will be selected for the RSRA.

Among the safety features planned for the RSRA will be an explosive device for disconnecting the rotor blades in case of trouble and a device for ejecting the crew members upward out of the vehicle in case of danger. The RSRA will also be provided with suitable hard points for mounting in the NASA/Ames 40 x 80-foot wind tunnel at Moffett Field, Calif.

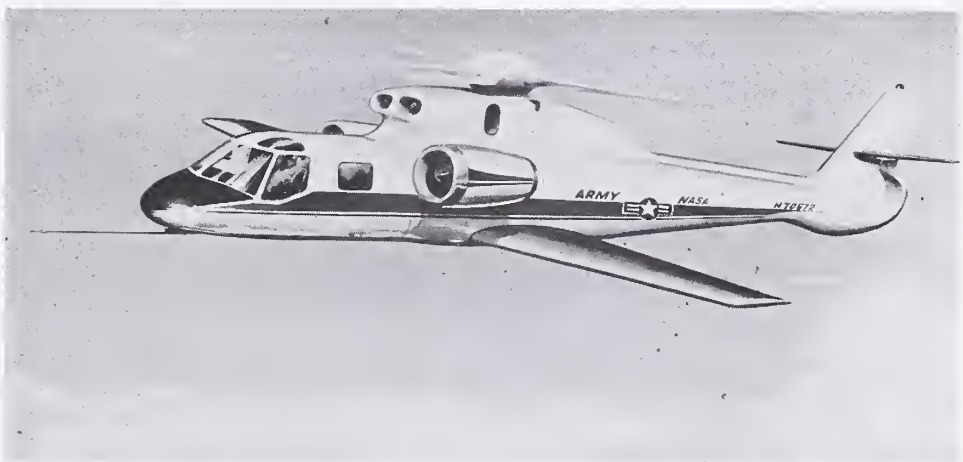
The technology on which the RSRA will be based draws heavily on the results of Army-sponsored flight programs with the Lockheed XH-51A compound helicopter, the Bell high-performance helicopter, the Sikorsky NH-3A compound helicopter, and the Kaman UH-2 helicopter.

The versatility of the fly-by-wire system with different control requirements has been established by the CH-46 Variable Stability Helicopter at Langley Field. Fly-by-wire is one of the requirements for the Heavy-Lift Helicopter presently under development, and technology from the Army Tactical Aircraft Guidance System will also contribute to the RSRA design.

The aviation industry has already demonstrated rotor vibration attenuation. The Bell focused-pylon system has been modified to a variable focus configuration for successful flights of a 2-bladed teetering rotor as well as a 4-bladed hingeless rotor—two systems with significantly different dynamic characteristics. Furthermore, the Sikorsky aircraft has successfully completed ground tests, under Army sponsorship, of an active isolation system.

The RSRA will be capable of speeds up to 300 knots (345 mph), and an average of 50 research-flight-hours per year is planned. There will be a 2-man crew, and possibly a third man will operate and monitor the various recording devices.

Predesign studies for the RSRA have been contracted to Bell Helicopter Co. and to Sikorsky Aircraft Division of United Aircraft Corp. The Request for Proposal for the RSRA is planned for March 1973, according to the current schedule.



Sikorsky Aircraft RSRA

Bell Helicopter RSRA

R&D News . . .

Army Applies Computer Science Technology to Psychiatric Services

Computer Support in Military Psychiatry (COMPSY) is a project that is demonstrating its value to the Department of Psychiatry and Neurology, Walter Reed General Hospital, Washington, D.C., and the Mental Hygiene Consultation Service, Fort Benning, Ga.

Established in 1968 under the sponsorship of the United States Army Medical Research and Development Command, COMPSY has conceptualized an information system that permits data retrieval on patients much more rapidly than was previously possible. Data is compiled from the time a patient is identified in the field, through diagnosis and treatment, until he reenters the military community.

A psychiatric patient is first identified through the Walter Reed in-patient file or the mental hygiene community field file. An index of all patient contacts throughout the system is contained on a psychiatry registry. This registry is used to facilitate inquiries concerning a patient's status within the system. Inactive record files are maintained on all patients not contacted within the preceding 150 days.

Personnel working in the COMPSY project feel that such a collection of total system activity provides a long-needed data base required for research that may aid clinicians in understanding psychiatric disorders.

Concepts and techniques of other psychiatry computer projects have been adopted to the COMPSY project, including those of The Institute of Living, Hartford, Conn., The Missouri Institute of Psychiatry (Standard System of Psychiatry), and the multi-state information system of Rockland State Hospital, Orangeburg, N.Y.

The COMPSY research team consists of a staff headed by the chief, Department of Psychiatry and Neurology, Walter Reed General Hospital, and representatives from psychiatry, psychology, nursing, social work, medical records specialists and computer sciences.

Upon admission for treatment, a patient's basic record is collected by the nursing staff and continuously updated throughout the patient's hospital stay. An integral part of the patient record is the Minnesota Multiphasic Personality Inventory (MMPI), a psychological screening test administered to most patients a few days after entering the hospital.

Any given information on a particular patient may be obtained by manipulation of a central computer file containing records of all patients and their daily activities.

Introduction of medical records personnel into the COMPSY system permits review of the medical record while the patient is still in the hospital, rather than after he has been discharged.

As computer hardware currently used by COMPSY is extended to other areas of the hospital information system, such as the laboratory, radiology, pharmacy and dietetics activities, an improved patient medical record is contemplated. COMPSY computer scientists, acutely aware of these developing systems, provide consultation to those originating them.

The Mental Hygiene Consultation Service, Fort Benning, Ga., is developing a field file application for the COMPSY model. Information for a community mental health record file is currently being collected on approximately 1,000 patients monthly. The goal is to provide a comprehensive mental health information base to include all of the post's hygiene facilities.

The community mental health record system reduces the duplication of work between agencies and provides a complete mental health history of each psychiatric patient. Epidemiologic studies on drug abuse, AWOLs and suicidal gestures have already been initiated.

Success of the COMPSY project is contingent upon the acceptance of automation by mental health professionals. At Walter Reed and at Fort Benning, acceptance has been high.

HDL Develops Fuel System Utilizing Science of Fluidics

An automobile engine fuel injection system with no moving parts that automatically produces the optimum fuel-air mixture, and can be set to produce minimal exhaust pollution, was announced recently by the U.S. Army Harry Diamond Laboratories, Washington, D.C.

Using the rapidly expanding fluidics technology, the system operates with air flow as a function of fuel flow. Conventional carburetors operate the other way around; they must be set for a "rich" mixture for power or a "lean" mixture for economy.

Developed after two years of effort, the fluidic system has a further advantage in that no accelerator reservoirs or pumps are required, because the fuel-air mix is always correct. Furthermore, the mix can be accurately matched to the requirements of the engine.

Long life, reliability and simplicity derive from the no-moving parts design. In cooperation with the Mobility Equipment Research and Development Center at Fort Belvoir, HDL installed the fuel injection system in a jeep engine and tested it to determine the most effective air-fuel mix requirements.

Results established that with the fluidic fuel injection system, optimum economy and maximum power capabilities are achieved without a change of fuel-mixture setting.

LWL Develops Improved Ration-Heating Fuel Unit

Combat soldiers can have hot food in seven minutes by using a simple, lightweight ration and a water heating fuel unit developed recently by the U.S. Army Land Warfare Laboratory (LWL), Aberdeen Proving Ground, Md.

Two Delrin discs joined through a slot from edge to center form a free-standing cruciform or "X" type fuel unit. Delrin, a stable acetal resin, serves as the fuel source. A small hole with a thinned edge in the center of each tablet facilitates easy lighting.

The LWL grid was developed to provide support for the ration can or canteen cup to be heated above the B-1A ration can, field-expedient stove (see photo below, right). Two rectangular pieces of light-gauge steel, secured as an assembly, form an "X" configuration when opened. The grid provides a one-inch standoff between the stove and the container being heated.

Development of the new fuel tablet was begun to overcome shortcomings experienced with the current standard Trioxane unit, which must be packaged in a vapor-proof overwrap. If exposed to moisture, Trioxane sublimes. Loss of the fuel and the resultant contamination of food have prevented Trioxane from being packed with combat ration.

Delrin, in contrast, is impervious to moisture and nontoxic. No overwrap is necessary, the tablet can be packed with the combat ration, and it can boil eight ounces of water in less than seven minutes.

Elimination of the need for packaging makes Delrin less expensive to provide in operational quantities than Trioxane.

The Surgeon General's Office has granted authority to package the fuel unit and grid with the standard combat ration. The grid will be packed in the same manner as the can opener and placed in the main carton, with four tablets (two fuel units).

Army Strives for Improved Low Altitude Helicopter Night Flights Through Utilization of In-House-Developed Night-Vision Goggles

Use of night-vision goggles for low-altitude, or nap-of-the-earth (NOE) helicopter night flights is showing promise as the result of co-operative efforts of two Army in-house laboratories.

In April 1971, the U.S. Army Land Warfare Laboratory (LWL), Aberdeen (Md.) Proving Ground, undertook a short intensive study of NOE flying for the Office of the Chief of Research and Development.

Objective of this study was to determine if any commercial or military system could be "packaged" to give Modern Army Selected Systems Test Evaluation and Review (MASSTER) an interim capability for flying helicopters NOE at night.

LWL began with the assumption that a pilot must have all the cues he receives during daytime NOE flying. Three possible solutions were considered: illumination (searchlights) to provide near-daytime conditions, a combination of sensors and cockpit displays, and night-vision goggles.

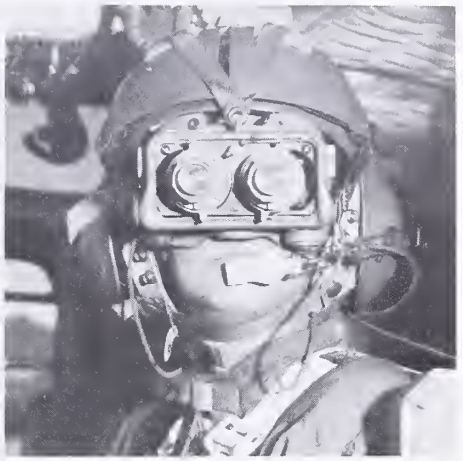
Goggles previously developed for ground use by the Night Vision Laboratories, Fort Belvoir, Va., proved to be the ideal interim solution. In July 1971, LWL began testing the goggles for nighttime NOE flying.

Light reflections on the helicopter windscreen proved to be the initial problem. However, this was remedied by painting the grey areas of the cockpit a low reflectance black, and flying with the cockpit and position lights off. Both pilots wear the goggles and the nonflying pilot monitors the instruments, operates radios, and assists in navigation.

Using this technique, trained pilots can fly NOE under a wide range of illumination conditions over a variety of terrains, and can execute all normal maneuvers including formation flight.

The goggles consist of two small image intensifiers mounted in a face mask. They have a 40-degree field-of-view, unity magnification, and weigh 29 ounces. A small mercury battery permits eight hours continuous use. Modification of the pilot's face mask allows attachment of the goggles to the helmet.

NOE flight tests with the goggles have been conducted under ambient light levels ranging from full moon to starlight. In reasonably level terrain when the light level is greater than one-quarter moon, goggle-equipped pilots can fly 10 feet above trees at 70–90 knots.



ARMY flyer demonstrates night-vision goggles used for nap-of-the-earth flying.

At light levels below one-fourth moon or in hilly terrain, a reduction of air speed is required. Supplemental illumination may be provided through a beam-spreader attachment to the standard landing lights during conditions of extreme darkness.

Flight tests have been conducted with the UH-1, AH-1G and OH-58 at APG, mountains of Western Maryland, and Fort Rucker, Ala. Additional tests are under way at Fort Hood and Hunter-Liggett Military Reservation.

Pilots can be trained to use the goggles in four hours—one hour of classroom training, one hour of daylight flight and two hours of night flight. Daylight flights are accomplished using goggles modified with the image intensifier replaced by a green filter.

Tests of the night-vision goggles are continuing at MASSTER for NOE flying to determine their operational use with weapon systems and acquisition devices. Principal advantages of the goggles are low cost, simplicity, availability and the fact that they are independent of the aircraft.

Enhanced Safety Achieved With New Ballistic Parachute

A ballistically deployed reserve parachute, which incorporates a canopy ejector to provide more reliable functioning, is the latest item developed by the U.S. Army to enhance the safety factor for the airborne trooper.

Over-all development of the ballistically deployed unit was the responsibility of the U.S. Army's Natick Laboratories, Natick, Mass. The parachute canopy ejector was developed by the U.S. Army Frankford Arsenal, Philadelphia, Pa.

Pulling the ripcord on the Ballistic Reserve Parachute serially fires two detonators, either of which is capable of activating the canopy ejector. The ejector, in turn, provides power deployment of the 24-foot diameter canopy by ejecting it down and to the jumper's right at an average velocity of 22.8 feet per second.

The cartridge-actuated ejector is noiseless and flashless, and the momentum of the ejector carries the canopy, which is packed in a deployment bag, to full canopy stretch. Deployment bag and ejector then descend on their own 36-inch parachute so that their weight will not interfere with the jumper's parachute.

The lateral ejection feature deploys the reserve canopy away from the malfunctioned main canopy, which is above the jumper, thereby minimizing the chance of entanglement between the reserve and the main parachutes.

The new parachute was developed because the T-10 reserve parachute was failing by becoming entangled in the main parachute lines, wrapping around the main canopy, dropping below the jumper without inflating, or blowing back and entangling with the jumper.

These failures resulted in jumper injuries of varying severity and an occasional fatality.

Tests of the ballistic reserve parachute have been completed and it has been completed and the new reserve has been type-classified as a standard Army item. The U.S. Air Force and U.S. Navy are also considering the item for adoption.

To reduce procurement costs, the U.S. Army Aviation Systems Command (AVSCOM) proposes that the new reserve be introduced to the field through modification of existing field and depot stocks of the current T-10 reserve parachute. In accordance with this concept of introduction, AVSCOM has submitted a Product Improvement Proposal to Army Materiel Command headquarters that defines the resources required for such introduction.

PREPRODUCTION MODELS of the Mobile Assault Bridge/Ferry (MABF), developed by the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va., are shown here undergoing tests on the Mohawk River at Schenectady, N.Y., near the Consolidated Diesel Electric Co., where they were built. The two units shown are an end bay and an interior ramp coupled to form a 2-bay raft. A multiyear, multimillion dollar contract will provide 122 units with interior-bay and 62 with end-ramp superstructures.

Army Reorganization Focuses on Improved Efficiency

Organizational changes designed to modernize, reorient and streamline the continental U.S. Army, announced Jan. 11 by Secretary of the Army Robert F. Froehlke and Chief of Staff GEN Creighton W. Abrams, will be completed within about 12 months.

Improved efficiency in line with constrained personnel and budget resources, and objectives of the modern volunteer Army, is announced as the primary objective of the realignment. The plan is expected to result in annual savings estimated at about $190 million annually when completed.

Conceived as a result of a special study announced by Secretary Froehlke last April, conducted under and direction of MG James G. Kalergis, the planned restructuring is intended to: improve readiness, training, the materiel and equipment acquisition process, the quality and responsiveness of management, and provide better soldier support.

Impacts of the plan include elimination of 813 positions within the Army staff in the Pentagon; transfer of an additional 1,986 individuals from the Department of the Army headquarters staff to other commands or field operating agencies; over-all reduction of 15,000 military and civilian personnel spaces.

Major organizational thrusts provide for elimination of the Continental Army Command (CONARC), the Combat Developments Command (CDC), and Third U.S. Army.

FORSCOM (Forces Command) will be created as a single field headquarters to supervise the unit training and combat readiness of all Army units, including the Army Reserve and National Guard.

TRADOC (Training and Doctrine Command) will be established as a single field headquarters to direct all Army individual training, education and the development of organization, materiel requirements, and doctrine. Other major actions include:

- Consolidation of the Munitions Command, now headquartered at Picatinny Arsenal, Dover, N.J., with the Weapons Command into an Armaments Command at WECOM's present headquarters, Rock Island, Ill.
- Consolidation of the major headquarters elements of the Electronics Command at the current main headquarters at Fort Monmouth, N.J., involving elements currently headquartered at Philadelphia, Pa.
- Conversion of the Mobility Equipment Command into the Troop Support Command at current MECOM HQ in St. Louis, Mo.
- Creation of a U.S. Army Health Services Command at Fort Sam Houston, Tex., to provide a single manager for Army medical activities in the U.S.
- Merging in place of the U.S. Army Safeguard System Command and the Safeguard Logistics Command at Redstone Arsenal, Huntsville, Ala., with concurrent reduction in strengths, and disestablishment of the Safeguard Central Training Facility, Fort Bliss, Tex.
- A reduction-in-force of the U.S. Army Engineer Division, Huntsville, Ala., and Malmstrom, Mont., the U.S. Army Safeguard Communications Agency, Fort Huachuca, Ariz., and U.S. Army Safeguard Evaluation Agency, White Sands Missile Range, N. Mex.
- Consolidation and realignment of the Army depot system.
- Elimination of major administrative levels between major Army posts and the Department of the Army.
- Increasing the responsibility, authority and flexibility of installation commanders.
- Establishing a major active Army organizational framework organized solely to improve Reserve component readiness.
- Improving the quality and administration of the Reserve Officers Training Corps (ROTC) program.

Headquartered at Fort Monroe, Va., long the headquarters of CONARC, the Training and Doctrine Command will concentrate on more intensive management of training and educating the individual soldier and officer; also, developing new organizational and doctrinal concepts for modern warfare.

TRADOC—which when fully constituted will have about 180,000 military and 40,000 civilian personnel—will play a major role in providing assistance for the training of FORSCOM's deployable units and the training of Reserve component units. This will involve disseminating workable training ideas throughout the total Army force to maintain and upgrade skills of soldiers within units.

TRADOC will have responsibility for Army schools at 22 installations, and will absorb the combat development functions that have been performed by the Combat Developments Command and CONARC. This entails the merging with the schools of 19 previously separate branch-oriented CDC agencies, presently collocated with associated schools.

The reorganization announcement stated that, by merging with the schools, "both combat developments and training will benefit from harnessing the wealth of experience found in the schools facilities and student bodies, and the organization charged with distilling the experience into new doctrine, organizational and materiel requirements."

In furtherance of linking combat developments to training, other existing CDC agencies and activities will be consolidated into three functional combat development centers. These will be collocated with key Army educational institutions—the Combined Arms Center at Fort Leavenworth, Kans.; Administration Center at Fort Benjamin Harrison, Ind., and Logistics Center at Fort Lee, Va.

ROTC programs, source of 65 percent of the Army's new officers, will be managed by TRADOC through "a dedicated structure of four newly established ROTC regional activities." These will be at Fort Bragg, N.C., Fort Riley, Kans., Fort Knox, Ky., and Fort Lewis, Wash.

Third Army HQ at Fort McPherson, Ga., will become FORSDOM HQ and the commander will be responsible for combat readiness of all Active Army, National Guard and Army Reserve forces in the United States and Puerto Rico. The reorganization is termed a major contribution to improved force readiness. "by enabling the senior commander to concentrate his attention on one mission—combat readiness."

The FORSCOM structure eliminates one management layer between the Department of the Army headquarters and the major tractical units, by removing the Continental Armies from the chain of command in the Active Army forces and from installation management.

In turn, this change permits Continental Army commanders to concentrate on the readiness and training of the Reserve components. In view of this reduction in responsibility, they will employ "considerably smaller staffs."

Continental Army commanders will be supported by nine small Army Readiness Region HQ of about 30 people each, serving as coordination points for Army Reserve and National Guard readiness, training and support.

First Army HQ, covering generally the geographic areas presently assigned to First and Third Armies, will remain at Fort Meade, Md. Fifth Army HQ will continue to be located at Fort Sam Houston, Tex., and Sixth Army HQ will stay at the Presidio of San Francisco, Calif.

When fully constituted, FORSCOM will have some 225,000 Active Army personnel and 660,000 Reserve components personnel.

Army Health Services Command. Located at Fort Sam Houston, the AHSC will perform medical supervisory functions consolidated from a variety of sources, including the Office of the Surgeon General in Washington, D.C., and headquarters of CONARC, First, Third, Fifth and Sixth Armies.

Concurrently, all Medical Service schools and the Medical Training Center will merge into an Academy of Health Sciences, under the Health Services Command.

Military Personnel Center. This one-stop personnel center for officer and enlisted personnel will fulfill another long-sought Army objective. Located in Alexandria, Va., the center will combine personnel assignment, career planning, counseling, automated accounting and other personnel-related functions now fragmented throughout the National Capital Region.

Additional changes include:

- Relocation of Recruiting Command HQ from Hampton Road, Va., to a more geographically favorable, mission-suited location at Fort Sheridan, Ill.
- Strategic Communications Command assumption of responsibility for installation communications-electronics support throughout the Continental United States.
- Further reorganization and reduction of manpower of the Army Intelligence Command, with a move of headquarters from Fort Holabird, Md., to Fort Meade, Md.
- Reorganization of the U.S. Army Criminal Investigation Command to eliminate intermediate headquarters and consolidate field agencies.
- Reduction in size of the U.S. Army Chemical Corps and eventual merger with the U.S. Army Ordnance Corps, including disestablishment of the U.S. Army Chemical School, Fort McClellan, Ala.
- Expansion of the Strategic Tactical Analysis Group, Bethesda, Md., into a Concepts Analysis Agency. Complementing the recently activated Test and Evaluation Agency established at Fort Belvoir, Va., the new group will provide the Department of the Army with a capability to analyze and study requirements and alternatives for new materiel systems and new force designs and operational concepts.
- Relocation of the U.S. Military Academy Preparatory School from Fort Belvoir, Va., to Fort Meade, Md.

Helicopter Vibrations . . .

A helicopter has often been described as a collection of vibrations and other motions traveling together. Helicopter engineers are very much aware of these vibrations, which can be catastrophic if they get out of hand.

In order to be able to measure some of these forces and thereby identify and correct the causes of problems, the U.S. Army Aviation Test Board at Fort Rucker, Ala., is developing a new instrumentation package consisting of three modified flight recorders, specialized track-

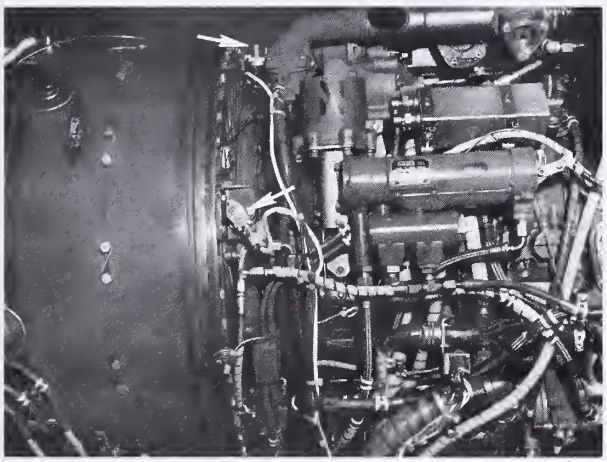


Figure 1

ing filters, and associated signal conditioning equipment.

Figure 1 shows two sensor units (white arrows) installed on the engine mount of a CH-47C Chinook. Each sensor is monitored by several data channels at pre-selected frequencies chosen to determine the magnitude of the forces under investigation under all flight conditions.

The new system will collect approximately 200 bits of data per flight-second and test component parameters without interfering with the helicopter or its crew. Figure 2 shows data acquisition units mounted in the cabin of the Chinook and receiving information from 20 sensors mounted on the engine and airframe. The system operates for a full day before the recording tapes must be replaced.

Figure 3 shows the ground playback console which transcribes data onto IBM-compatible tapes. It also provides data-plot capability as well as limited date search and printout. The tapes from this machine

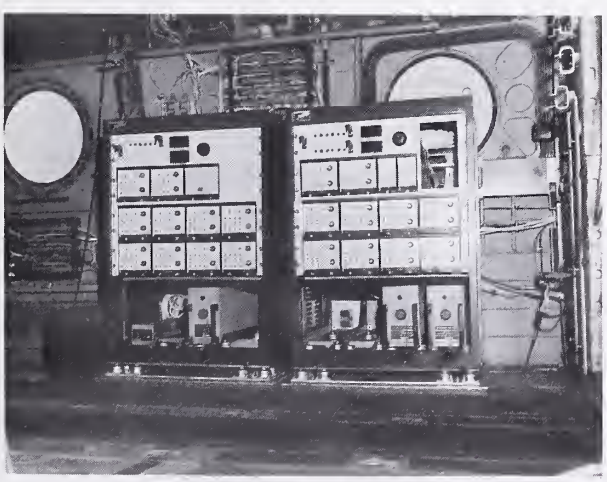


Figure 2

Figure 3

are then processed by an IBM-360-50 computer to furnish information for the test project engineer.

Typical computer data furnished all measurements that exceeded such selected values as correct engine speeds or allowable vibrations of test components, graphic presentation of the portion of time spent in each flight mode of the aircraft, or all data for any given interval of time.

The new system will improve the ability of the Army Aviation Test Board to evaluate equipment.

AVSCOM Toasts 20 Years of Ongoing Service

The U.S. Army Aviation Systems Command (AVSCOM), filled with a history of change and expansion, recently celebrated its 20th birthday. Established as the Transportation Corps Army Aviation Field Service Office (TCAAFSO) in 1952, it functioned as a supply and maintenance activity for the Army aviation program.

Comprised of a force of five officers and 48 civilians, TCAAFSO actually began operations in 1953. The St. Louis location was chosen because of its central location to needed resources such as aircraft manufacturers, Army aircraft density, transportation facilities and available labor.

Assuming responsibility for stock items held at various Army depots, it was renamed the U.S. Army Transportation Supply and Maintenance Command (TSMC) in 1955.

A major reorganization of the Army in 1962 created the Army Materiel Command (AMC) and TMC (TSMC's new abbreviation) came under the jurisdiction of the Army Mobility Command (MOCOM), a major subordinate of AMC. Because about 85 percent of the command's business was in the field of aviation, it was renamed the U.S. Army Aviation and Surface Command (AVSCOM) in 1964.

In a move to separate surface and air functions of AVSCOM, a decision was made to once again rename it. This time, in February 1964, it became the U.S. Army Aviation Materiel Command (AVCOM). Responsibilities for procurement, supply and maintenance of air delivery equipment were assigned. AVCOM also assumed operational control of the Army Air Delivery Liaison Office at Fort Bragg, N.C.

AVCOM became a major subordinate command of AMC in 1966 and gained responsibilities for aircraft standards and qualifications with assignment of the Aviation Test Activity at Edwards Air Force Base, Calif. Reorganization proposals submitted in 1967 by AVCOM commander MG (now LTG) John Norton resulted in adoption of its present title in 1968.

The following year AVSCOM was selected as lead AMC command for the AMC Logistics Program Hardcore Automated (ALPHA) conversion program.

From its humble beginning in 1952, AVSCOM has grown to become one of seven commodity commands subordinate to AMC, encompassing a work force of about 150 military and almost 4,000 civilian personnel. It supports over 600 Army-type aircraft in the Air Force, about 350 in the Navy and over 1,200 aircraft in more than 30 foreign countries. Resources used by AVSCOM in support of the aviation program total about 50 percent of the entire AMC budget.

AMMRC Gives Fibers a New Twist

New Machine Technology Improves Winding of Contoured Composites

By Dr. Bernard M. Halpin Jr.

The Composites Division of the Army Materials and Mechanics Research Center (AMMRC) at Watertown, Mass., has enlarged its filament winding capability by the acquisition of two new machines.

AMMRC entered the field of filament winding early in 1970, utilizing a mechanical winding machine. The winding angle of this machine is set by a combination of chains and gears. It is ideal for straight cylindrical sections but not particularly suited for contoured parts. It soon became obvious that AMMRC needed more sophisticated equipment if it was to be responsive to the Army's needs in the field of filament-wound fiber/matrix composites.

The two new machines acquired in the fall of 1971 include a lathe-type similar to the first machine but with a larger capacity, which can be programed to wind contoured shapes. The other one is a tumble or polar winding machine.

On the tumble machine, the mandrel is rotated while the delivery system remains fixed. The angle of wrap is set by aligning the rotating arm at an angle to the plane of the delivery system. The machine has been used in a study to determine the effect of the angle of wrap on the ability of a fiberglass hemisphere to withstand ballistic impact. Figure 1 shows Clifford E. MacQueen operating the tumbler during a filament-wound hemisphere study.

Three angles of wrap were chosen for this study, $\pm 35°$, $\pm 20°$ and $\pm 8°$. These represent the highest and lowest angles that could be applied to a double-poled 7-inch sphere, and an intermediate angle. The material chosen for the study was the same fiber and resin composite used in the glass woven-roving backup material for ceramic body armor.

The results of tests on the spheres with the higher angles of wrap were encouraging, but further work on mandrel design is necessary to fully utilize this method of fabrication. An extension of this study using ribbons of XP, a polymeric film material proprietary to Phillips Petroleum Co., is in progress. XP has displayed excellent ballistic resistance when tested in laminated films.

The new lathe-type machine has been used extensively in the Short-range, Man-portable, Antitank Weapon Technology (SMAWT) program. It is also assisting both the Missile Command (MICOM) and the Weapons Command (WECOM) in their respective hardware demonstration programs.

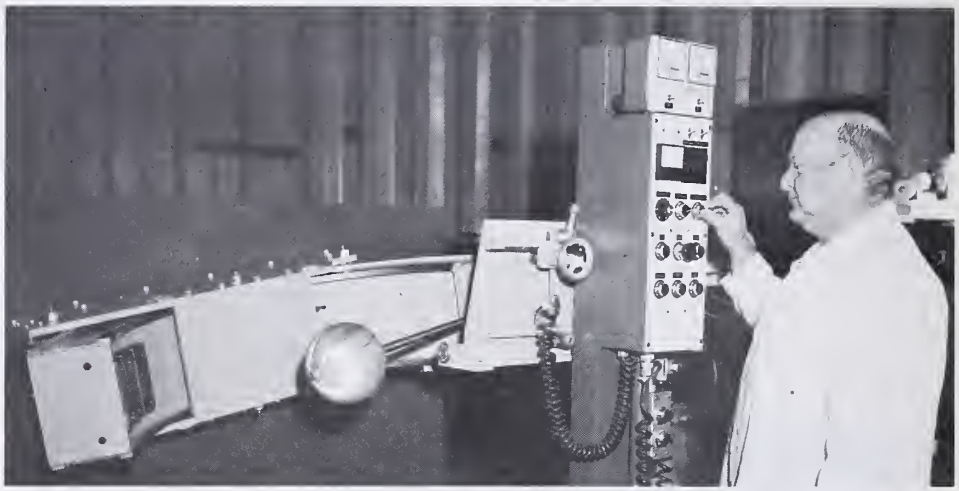


Fig. 1. Clifford E. MacQueen is shown operating tumbler winder during filament-wound hemisphere studies at U.S. Army Materials and Mechanics Research Center (AMMRC).

Fig. 2. Antonio W. Reppucci, displays Advanced Light Antitank Weapon parts.

Under the SMAWT program, AMMRC is engaged in a joint study with the Ballistic Research Laboratories (BRL) of filament-wound transition zones which occur in parts having more than one diameter. The transitions were chosen by BRL as typical of both rocket motors and recoilless rifles.

The Composites Division of AMMRC is fabricating a series of parts on BRL mandrels. Testing and evaluation of the parts will be conducted by the Mechanics Research Laboratory of AMMRC and by BRL. The results will provide design information on filament wound double-curved parts.

AMMRC recently completed a study on the launch tubes used in the MICOM Advanced Light Antitank Weapon (ALAW) system. Figure 2 shows some examples of ALAW components. A number of tubes were fabricated using S-glass with two different finishes and three different resin systems. The launcher consists of two telescoping tubes; MICOM tolerances were maintained throughout the study.

In addition to the dimensional tolerances, the tubes were checked for fiber volume and void content (pores developed during cure of the resin) by a point count method used by Miss Elizabeth

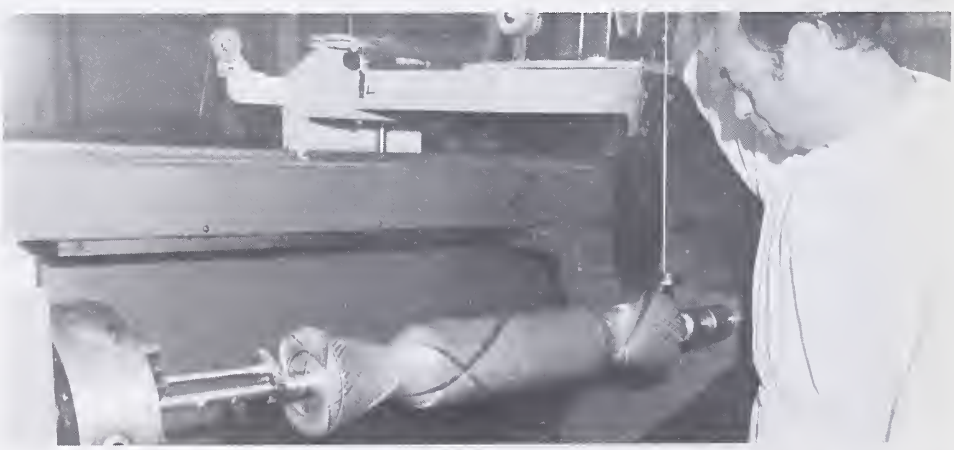


Fig. 3. WINDING of WECOM recoilless nozzles. Each complete winding operation produces two nozzles for the U.S. Army's new Advanced Light Antitank Weapon.

Cilley of the Composites Division. The tubes were strain gauged and tested at MICOM.

Another part of the AMMRC filament winding operation is a joint program with WECOM to investigate the construction of recoilless rifle parts of both wet-wound S-glass and PRD-49. The resulting items will be compared with similar pieces fabricated at Watervliet Arsenal from material preimpregnated with resin.

Figure 3 shows the winding of the nozzle section of the WECOM recoilless rifle. During this operation the machine must follow an intricate pattern, slowing down in the throat region to allow the filaments to maintain a stable path along the entire piece. The stable path insures that the filaments will not slide on the face of the mandrel.

Extra rotation programed into the ends of the operation creates a single circuit pattern; that is, each filament lies adjacent to the one wound on the previous pass. Such a pattern minimizes the number of times the filaments cross over each other during the winding operation. The effect of the number of crossovers is also to be studied under the SMAWT program.

PRD-49, an organic fiber produced by Dupont, will be included in the WECOM study because of its potential weight savings over glass. It has a negative thermal coefficient of expansion along the direction of the fiber, but a positive coefficient transverse to the fiber, an effect that makes it difficult to use in thin-walled telescoping tubes. The thermal problem, coupled with the difficulty of machining PRD-49 composites, led to a decision that the material would not be used in the MICOM ALAW project. The WECOM launcher is not thickness sensitive and extensive machining is not required; therefore it was decided to include PRD-49 in the WECOM program.

The Composites Division of AMMRC has many plans for its filament winding operation. The exploration of new materials such as PRD-49 will continue. Acquisition of new dielectrometric monitoring equipment will allow experimentation on the curing of wet-wound composites while the material is on the mandrel.

Certain applications of composites have been rendered impractical because of difficulties in joining them to other materials, such as metal universal joints for composite drive shafts. Methods of winding such components that will be less sensitive to fatigue and shear at the root-end will be sought to overcome this problem. And, as in the case of the ALAW hardware demonstration program, the AMMRC always is ready to aid the Army Materiel Command's commodity commands in filament-winding problems.

DR. BERNARD M. HALPIN JR. has been working as a research chemist at Army Materials and Mechanics Research Center since July 1969. His educational background includes a BS in chemistry from Merrimack College in Andover, Mass., and a PhD in organic chemistry from Boston College.

After starting with the organic synthesis group, he has been actively engaged for the past two years in the filament winding portion of the AMMRC composites program.

Inter-American Conference on Materials Planned

Plans being developed for the Fourth Inter-American Conference on Materials Technology, scheduled for October 1974 in Buenos Aires, Argentina, anticipate the participation of more than 600 scientists, engineers and administrators.

Dr. Thomas E. Sullivan, chief of the Materials Sciences and Technology Team, Directorate of Army Research, Office of the Chief of Research and Development, is a member of the executive committee planning the conference.

The committee will meet in Guatemala City, Guatemala, Mar. 12–13, to establish the parameters of subjects to be included in the agenda.

Dr. Sullivan said that U.S. Army interest in the conference is linked to a desire to assess the potential for using unique materials research capabilities in Latin American countries, as well as in maintaining cognizance of the over-all state-of-the-art in materials science and technology.

Sponsors of the Third Inter-American Conference on Materials Technology, held in Rio de Janeiro, Brazil, this past August, included the United Nations Industrial Development Organization, the Organization of American States, the U.S. National Science Foundation, the U.S. Regional Technical Aids Center, Inter-American Development Bank, The Ford Foundation, the United Nations Industrial Bank, Centro de Investigacion de Materiales of Mexico, and Comision Nacional de Energia Atomica of Brazil.

MICOM Announces Resumption Of Pershing Missile Production

Resumption of Pershing missile production, which was terminated in 1965, has been announced by HQ U.S. Army Missile Command, Redstone (Ala.) Arsenal. Eight major contractors are producing the 500-mile-range missile.

Project manager COL Samuel C. Skemp Jr. explained that "the Army is merely replacing its firing losses" in view of several product improvements and increased storage life that have extended the Pershing's estimated life span from 1972 into the 1980s.

Expected to be more reliable and accurate, the new missiles will be tested at White Sands (N. Mex.) Missile Range. Production is planned for about three years.

Following termination of research and development firings in 1963, the Pershing system was deployed with battalions in the U.S. and in Europe.

ODDR&E Designates Dr. Medin for Key Position

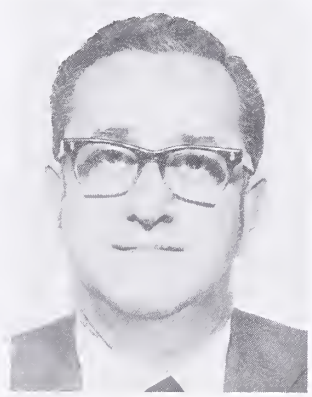
Designation by the Office of the Director of Defense Research and Engineering of Dr. A. Louis Medin as Assistant Director (Environmental and Life Sciences), Office of the Deputy Director (Research and Advanced Technology), was announced Jan. 24.

The Office of the Deputy Director (Research and Advanced Technology) has responsibility for DoD research and development programs. This includes the entire basic research program, and technology programs in environmental and life sciences, engineering technology, and electronic and physical sciences.

Dr. Medin's technical interest responsibilities include applied research, exploratory development, advanced development and systematic assessment of military needs for these activities in the fields of: Chemical Warfare and Biological Defense; Biomedical Research and Technology; Space, Atmospheric, Terrestrial, and Oceanic Environment; the Behavioral and Social Sciences as they relate to military operations; and Environmental Pollution Control.

In addition, he is responsible for surveillance of the quality of the defense in-house laboratories, and for conception and implementation of programs to foster their improvement.

Dr. Medin was with the IBM Corp. in Gaithersburg, Md., until he accepted his new position. A graduate of Johns Hopkins University, where he received a bachelor's degree in engineering, he received his PhD from Ohio State University.



Dr. A. Louis Medin

Computer-Aided Design and Engineering . . .

MERDC Uses In-House CAD-E for Design of Electrical Equipment

By Robert M. McKechnie III

In current research and development of electrical equipment, ranging from cryogenic solenoid designs to graphical displays for electric-drive vehicles, engineers and physicists are using in-house computer facilities at the U.S. Army Mobility Equipment R&D Center (MERDC), Fort Belvoir, Va.

The MERDC Computer-Aided Design and Engineering (CAD-E) facility has evolved from an AD-256 analog computer, purchased in 1964, to a modern interactive graphics facility of the Electrical Equipment Division, Electrotechnology Department. The configuration currently includes:

• *Teletype Time Share Terminal*—This teletype system is a 110 Baud tie to a commercial time-share system which provides specialized electrical design programs and also connects to MERDC and other government time-share systems for a broader data base.

The teletype system consists of an ASR-33 teletype with keyboard, teletype printer and paper tape input/output (I/O). It is also equipped with a TSP plotter controller which drives a Tektronix 601 oscilloscope and HP X-Y recorder for on-line graphical display.

• *Interaetive Graphies Terminal*—The interactive graphics terminal consists of a Varian 620 minicomputer processor with 32K of core (16 bit words) memory, 4 magnetic tape drives (COI link tapes), high-speed (200 character/second) paper tape I/O, 400 lpm Vogue line printer, Infoton alphanumeric CRT I/O, Ards 100A graphics unit with joystick, and a KSR 35 teletype. Plans for late FY 73 call for a high-speed disk to be added.

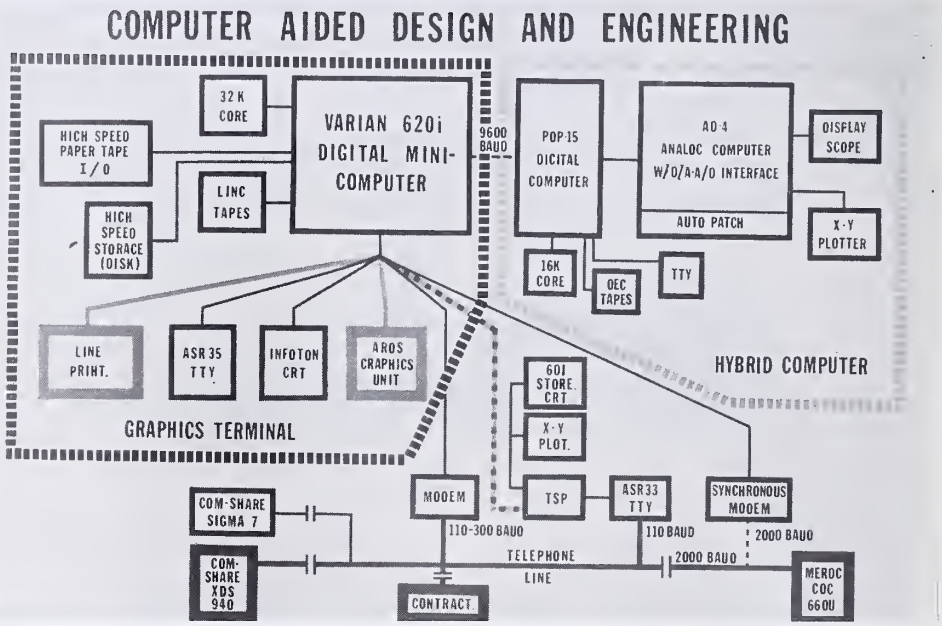
The system also includes a high-speed controller for use with a Modem to tie to the MERDC 6600 computer or to any other time-share system that will permit ASCII data transfer directly between computers, presently at rates up to 300 Baud with future plans for a 2000 Baud data rate.

• *Hybrid Computer*—This is an AD-4/PDP-15 hybrid system. The AD-4 analog computer has integrators, amplifiers, servo-set potentiometers, hand-set potentiometers, multipliers, DACs, digital coefficient units (DCU) with large-screen oscilloscope and X-Y plotter output.

The PDP-15 digital computer consists of 16K of core (18 bit words) memory, 3 DEC (magnetic) tape units, and KSR-33 teletype. The PDP-15 is connected through 9600 Baud controller to the graphics terminal. The hybrid system is equipped with operational hybrid software.

Throughout the over-all concept development, it was considered mandatory that each part of the CAD-E facility be capable of communication with each other part, thus providing a powerful computational capability. As can be seen in the chart above, a very important feature of this system is that contractor personnel can use the MERDC programs through the phone tie. MERDC personnel can likewise connect to contractor computers through the telephone tie and make use of specialized programs without additional program development.

For example, the CAD-E facility can be used as a hybrid interactive graphics system with the MERDC 6600 providing the necessary data base. In a sense, the graphics terminal can be considered as a processor with the hybrid computer, MERDC 6600 computer, commercial time-share computers, and contractor facilities (test equipment or computers) as peripherals.



The MERDC CAD-E activities, for example, are being assisted directly through the AMC CAD-E program with funding to develop "Automatic Interactive Graphical Programing," "Programing Language for Machine Self-Organization of Hybrid Computation," "Applications of Computer Techniques in Elastomer Research."

Several programs have been developed for automatic graphical display, using the graphics terminal to provide answers for electric-drive vehicle R&D. These programs have also been written for solutions on digital computers and analog computers.

Reports published about these programs include: *VEH Digital Computer Program,* MERDC Report 1968; *Simulation of Electrie Drive Vehicles,* MERDC Report 1973; and *MPMPH: A Digital Computer Program for Computer-Aided Design,* MERDC Report 2003. A hybrid computer program for solution of a complex electric vehicle problem is now being developed.

Complex machinery design problems are being solved with this facility. One solution provides an on-line flux distribution plot on the graphics screen for the synthesis and analysis of electric machinery, including time variance. A cryogenic turbomachine system design program has been developed to provide graphical output for use in R&D studies.

A 3KW electric power conditioner is being designed, making use of the full computational capabilities of this facility. The program will use the graphics terminal interconnected to the commercial time-share company and the hybrid computer to provide a design which considers cost, electrical, mechanical and reliability models.

Using models, the designer can analyze the cost and reliability implications of an electrical design modification. Through this approach a true low production cost system will be designed instead of a pseudo-low cost system, because the cost is considered in a parallel model instead of in a serial model which freezes electrical design first.

ROBERT M. MeKECHNIE III is a supervisory researeh eleetrieal engineer in the Electrieal Equipment Division, Eleetroteehnology Department, U.S. Army Mobility Equipment Researeh and Development Center, Fort Belvoir, Va.

A native of Texas, MeKeehnie reeeived a BS degree in eleetrieal engineering from Texas A&M University in 1959 and took his master's from George Washington University in 1963.

He has been a eivilian employe at the eenter since 1968, and was the recipient of an Outstanding Performance Rating and a Speeial Aet or Service Award in 1971. He is a member of the Institute of Electrical and Eleetronics Engineers.

Armed Forces Discuss Pollution Control At Army Environmental Quality Conference

An overview of Armed Forces efforts to control or eliminate sources of pollution was presented by speakers at the third annual Conference on Army Research and Development for Environmental Quality at Virginia Military Institute, Lexington.

More than 50 representatives of Department of the Army agencies joined with the Air Force and the Navy speakers. Discussion covered environmental quality research and development activities during the past year, and planning of programs to accelerate future progress.

Army speakers represented the U.S. Army Materiel Command, the Office of the Chief of Research and Development, the Office of the Surgeon General, and the Office of the Chief of Engineers.

MG Willard Roper, chairman of the Board of Engineers for Rivers and Harbors, was the luncheon speaker. In explaining some of the major efforts in pollution control in the Corps of Engineers Civil Works Program, he discussed regional planning for wastewater management, control of storm water runoff, and land disposal of wastewater.

Through the U.S. Army Cold Regions Research and Engineering Laboratories, Hanover, N.H., the Corps of Engineers is conducting an experimental program to develop the technology of land disposal of wastewater after treatment. He expressed the belief that this is a very promising disposal method. (See article on page 13, September 1972 *Army Research and Development Newsmagazine.)*

The purpose of the conference was to present information and stimulate discussion on the most recent developments in environmental quality research through reports by each developing laboratory.

MG Richard L. Irby, superintendent of Virginia Military Institute, welcomed conference attendees. Army Director of Research BG Charles D. Daniel Jr. gave the introductory remarks, in which he stressed the need for coordination in over-all program development.

Because of the magnitude of the research programs entailed in developing an effective antipololution program and control procedures, coupled with an austere budget, he challenged researchers to use existing resources wisely and to establish realistic priorities in obtaining timely solutions to problems.

Emphasis at this year's conference was shifted to the scientific aspects of improving environmental quality. Numerous significant accomplishments were detailed in the discussions. The emphasis during the first two conferences was on the organizational approach and review of the plans and activities in a developing program.

Considerable progress was reported by Army speakers in methods of treating and disposing of wastewater, certain metal plating process wastes, and recycling of munitions manufacturing wastes. Much work remains to be done in improving techniques in these areas, it was reported, as well as placing increased effort on control of air pollutants, and disposal of military solid wastes.

4 Pershing Missiles Fired in Cape Kennedy Tests

Four Pershing missiles were fired at Cape Kennedy (Fla.) Air Force Station during recent operational tests designed to evaluate the efficiency of the weapon system and combat units under simulated battle conditions.

The missiles, ground-support equipment, and soldiers of the U.S. Seventh Army were flown in from Germany for the tests which marked the first launchings of a major Army missile at Cape Kennedy since Pershing research and development firings concluded at the Cape in 1963. The missile has been operational for almost 10 years.

AN/PSN-7 Land Navigator . . .

Simplifies Position Readings for Infantrymen

Improved ground navigation for Infantry and combat support elements is provided by an instrument developed by the U.S. Army Land Warfare Laboratory, Aberdeen Proving Ground (APG), Md.

The AN/PSN-7 Land Navigator has an electronic compass that continually monitors an operator's "heading" as he walks. Each step is measured by small coils attached to his boots.

Information fed to the backpack compass carried in a standard PRC-27 harness, is combined with heading information to compute a soldier's position at any given instant. This position data is then continuously displayed on a hand-carried or belt-clipped control unit.

Position readings are presented in standard 8-digit UTM coordinates with a 10-meter resolution. System error is 2.5 percent of distance traveled. The entire unit weighs 11 pounds without the harness. The backpack weights 7.5 pounds including batteries.

Operation of the unit is simple. After attaching coils to his boots, a soldier sets his calibration number and local magnetic declination on the backpack, dials his initial coordinates on the control unit and starts walking. The PSN-7 automatically measures the length and direction of each step, and continually updates and displays position with no need of operator computations.

Principal components of the system include the compass, the automatic step-length circuitry, the logic and display circuitry and the power supply. The electronic compass, considered the heart of the system, is a dual-coil, fluxgate type. It senses the earth's magnetic field with respect to coil position, and produces an output which is a function of heading angle, rather than field intensity.

Power is supplied by two standard BA-1100/U batteries weighing one-half pound each. Sensors accurately provide a low battery warning and disable the unit if ignored. Battery life is rated at 24 hours of continuous system operation.

Utilization of the new device has demonstrated that it can provide the small unit commander with more accurate positioning data and navigational capability than currently possible with conventional means. It provides capability during all weather conditions, in all types of terrain and may be used immediately upon insertion into areas where common navigation systems have not yet been placed.

Additionally, the AN/PSN-7 permits the artillery forward observer to locate his own position accurately. Previous studies have shown that this factor contributes as much as poor range estimation to the inaccuracy of first-round artillery fire.

Equipped with an AN/PSN-7 and a laser range finder, the field artillery is one step closer to the long-sought goal of a first-round-hit capability. Successful field tests of the system have been made at Aberdeen, Sam Houston National Forest and Fort Hood, Tex.

COMBAT SOLDIER displays AN/PSN-7 Land Navigator System. Inset shows coils attached to the boots of the operator.

After Operating 10½ Years in 'Tempo 7' . . .

2,600 Headquarters Personnel Moving to Ultramodern $15 Million AMC Building

More than 10 years after the U.S. Army Materiel Command was established as the most powerful and widespread organization of its kind in U.S. history, some 2,600 headquarters personnel are moving from World War II Temporary Building 7 to a new 13-story, ultramodern $15 million AMC Building.

Scientifically designed to meet AMC operational requirements in an efficiently convenient manner, the structure is leased from the LNT Corp. Ten stories above and two stories below the ground level facilities provide approximately 470,000 feet of floor space, about 400,000 of which will be occupied by AMC activities.

Except for a well-equipped health service facility for AMC employes, most of the ground floor space is being leased to private concerns for convenience facilities to serve employes. These will include a 450-seat cafeteria, a 122-seat more elegant lounge-type eating facility, a barber shop, hair stylist, dry cleaner, full-service bank, and other enterprises still being decided.

The AMC Building—the name selected in a contest that drew more than 500 entries and earned the suggester a $100 award—is located at 5001 Eisenhower Avenue, Alexandria, Va. It is about one-half mile off Van Dorn Street and approximately one mile in back of Cameron Station, one of the Army's larger Washington, D.C., area complexes.

Some exployes privileged to make a preview examination of the new headquarters in its final stages of construction have termed the move "a transition from minimal to maximal" operational accommodations. That possible over-statement—in view of a few relatively minor conditions awaiting corrective action—is understandable after 10 years of AMC operations in Bldg. Tempo 7.

In officially restrained language, an AMC announcement to personnel states:

"Our new building contains some of the finest office space ever provided [U.S.] Government employes. The interior of the building is tastefully decorated. The colors of walls, floors and trim were especially developed to make your office a most pleasant place to work.

"All partitions were selected to provide efficient sound control. Placement of partitions is designed to allow maximum work flow. . . . All lighting in the building is fluorescent and eye comfort is not dependent upon whether or not there is a window in the office.

"The building is equipped with a unique 'zoned' environmental control system to provide for responsive temperature and freshness of air in your office."

Pride of employes in the beauty and the convenience of facilities in the AMC Building appears solidly insured by long years of careful planning to provide a desirable working environment. The entrance foyer is large and impressively prestigious without ostentation. One of the focal points is a stained glass mural.

Travertine marble slabs imported from Italy line the lobby pillars and some of the walls. Eye-appealing contrast is provided by rough-cut, narrow marbleized brick laid vertically on other walls. A new type of terrazzo flooring, believed the first of its kind installed in a Washington, D.C., area building, is composed of precast, prefinished 12-inch squares laid like vinyl or asbestos tiles.

Perhaps the comfort feature that will be appreciated most by employes is "total electric" temperature, air conditioning, humidifying and power systems—in line with current national objectives of minimizing environmental pollution. Except for the Nassif Building in Washington, the AMC Building is believed one of the largest total electric facilities in the Washington area.

Separate heating, air-conditioning and humidifying systems, one for each quadrant of the building, will meet about two-thirds of comfort requirements. The remaining one-third will be served by perimeter control units under each window in all offices. These can be adjusted by occupants to compensate for temperature changes due to varying weather exposure of exterior walls.

Precise automatic control is designed into the large computer center where temperature can be maintained at plus or minus 1 to 2 degrees and humidity within 2 percent of desired levels. Similarly accurate controls are provided for optimal operational efficiency in a large photographic laboratory where the air and water also are filtered.

Central scheduling to assure maximum utilization will apply to the use of two large special conference rooms and a 200-seat auditorium equipped with modern audio-visual systems, as well as to 20 smaller general-purpose conference rooms stacked above each other, 10 at each end of the upper 10 stories.

Eleven elevators operating at 350 feet a minute assure rapid movement of personnel throughout the building. All areas secured for classified information are safeguarded by an electronic intrusion detection system, and security guards are stationed in the lobby.

COMMAND GROUP personnel will be located on the tenth floor, where a visitors bureau and an Equal Employment Opportunity Office also are placed. The Directorate for Requirements and Procurement occupies the ninth floor and the Directorate for Research, Development and Engineering is on the eighth floor.

The seventh floor will accommodate the Office of the General Counsel, the Surveillance, Target Acquisition, Night Observation and Selected Systems Office, the Aviation Office, Information Office, Office of the Chaplain, AMC Technical Library, and AMC Credit Union.

On the sixth floor will be the Directorate for Supply, Directorate for Logistic Operations, and a snack bar. In addition to this food service facility, a carry-out line near the entrance

to the cafeteria will provide much the same choice of food packaged for those desiring to eat in offices or outside the building. Vending machines conveniently placed throughout the building will offer coffee, soft drinks, cigarettes, candy, etc.

The Directorate for Installations and Services, Directorate for Maintenance, and Directorate for International Logistics are on the fifth floor.

Fourth floor occupants will include the Directorate for Quality Assurance, Cost and Economic Information Office, Directorate for Management Information Systems, Security Office, and Safety Office.

The third floor will have the Office of the Comptroller, Historical Office, and the Office of the Surgeon. The Directorate for Personnel, Training and Force Development is on the second floor.

Except for the use of accent colors on randomly selected walls, doors and pillars, such as gold, red, green and blue, the entire building is painted a soft off-white. Drapes and carpets will be installed in offices of these authorized such niceties.

Despite the tremendous improvement in the quality of the offices and the exterior beauty of the AMC Building, some employe criticism is surfacing. Most of it is focused on the anticipated traffic congestion where main arteries converge in the huge Landmark Shopping Center area, about 1½ miles away, and from there along Van Dorn Street and Eisenhower Avenue.

Relative to the concern about traffic jam-ups, some employes have summed up the situation rather neatly by saying: "What could be worse than the Tempo 7 area?" For 10½ years the old-timers among AMC employes have been contending with the density of traffic from and into Washington's National Airport and the maximum concentration of high-rise structures in the surrounding area.

The AMC Building offers the advantage of accessibility from all parts of the Greater Metropolitan Area of Washington by three major highways—namely Duke Street leading from Route 236 directly into Van Dorn Street, Shirley Highway (Route 95) and the Capital Beltway (Route 495). Other feeder routes include Edsall Road and Franconia Road.

Other current problems expected to occasion some employe complaints include the lack of eating facilities in the area within a mile or so of the AMC Building, and a charge of $12.50 a month for those who will use 1,765 outdoor parking spaces. Employes with a handicap condition will be able to obtain a privileged parking location by providing a current copy of a medical report to the Department of Defense Building Administrator.

Visitor parking for persons on official business is provided in the west parking lot near the northwest corner of the building. Employes expecting a visitor who desires parking space must contact the building administrator, in advance, extension 274-8099, giving the name, make of vehicle, color of vehicle, license number, and expected time of arrival.

When the move from Tempo 7 to the AMC Building is completed, currently expected about Mar. 1, LTC Richard Woolshager will be one of those entitled to heave one of the biggest sighs of relief. Since he returned from a tour of duty in Vietnam, he has been devoting full time to construction problems and arrangements for the move as the AMC coordinator. That duty started with the ground-breaking ceremonies in August 1971.

Serving in a similar role for the Glassman Construction Co., primary contractor, is Robert Kaufman. The building architects are Holle and Graff of Bethesda, Md.

MERDC Develops New Cryogenic Cooling Unit

Cryogenic technology is incorporated in a new refrigerator featuring a turbine-alternator no larger than a pair of flashlight batteries. Described by the U.S. Army Mobility Equipment Research and Development Center as the forerunner of larger units, the refrigerator was recently tested successfully at Fort Belvoir, Va.

The test involved operation at 58 degrees Kelvin (minus 355° F.). The larger unit being developed to meet requirements for reliably cooling of superconductors in electric power equipment is designed for operation at temperatures of below 5° Kelvin (minus 450° F.). Developmental work is being done under contract.

Low-temperature superconductors can carry very large electric currents without the Joule heating which is a major problem in power machinery. For some high-power applications, the cryogenic approach results in over-all size reduction compared to conventionally cooled machinery.

The refrigeration unit consists of a compact heat exchanger, a compressor, and a miniature turbine-alternator with helium gas bearings. These bearings permit the turbine-alternator's 18-gram rotor to spin at 180,000 rpm at cryogenic temperatures. Since they have no rubbing parts during operation, the bearings promise long turbine life.

Operating in a reversed Brayton Cycle, the unit uses helium gas as a refrigerant. Room-temperature helium is compressed to three atmospheres, which cause its temperature to rise. After the pressurized gas is cooled back to room temperature, it is cooled to cryogenic temperatures by passing through the exchanger.

The pressurized gas then passes through the turbine, where it expands and cools further. An alternator on the turbine shaft converts the energy of the expanding gas to electrical energy, which is conducted out of the cryogenic system.

When the helium leaves the turbine-alternator, it passes through the refrigeration load and then back through the heat exchanger again. There it cools incoming pressurized helium and is warmed to room temperature. The out-going gas is then returned to the compressor to begin the cycle again. The entire system is thermally insulated by a vacuum.

A turbine expander of the type used in this system has been operated at 100,000 rpm for 6,600 hours, or more than nine months, without failure and without maintenance.

ISEF Winners View Nobel Prize Awards, Japan Student Science Exhibits

Nobel Prize award ceremonies in Stockholm, Sweden, were viewed recently by three young American scientists as honored guests, participating under the sponsorship of the U.S. Army, Navy and Air Force in a new program expected to continue in future years as "Goodwill Ambassadors Abroad."

Each of the U.S. Armed Forces selected a representative from among the leading award winners in the 23d International Science and Engineering Fair (ISEF) at New Orleans, La., an event that attracted more than 400 regional high school science fair winners from many nations.

While attending ceremonies in the St. Erikmassen Exhibition Hall in Stockholm, Harold Loveridge (Army), Cindy Lindsay (Navy) and Van Wedeen (Air Force) were accorded the rare privilege of conversing with numerous science Nobel Laureates from the U.S. and abroad.

They were escorted on a walking tour by Swedish students, visited Parliament and attended the Nobel Prize banquet and ball. Other features of the rigorous 13-day schedule included a press conference of Nobel Laureates and a tour of Swedish television studios, culminating in their taped interview.

The foreign visitors took particular interest in a Nobel Prize lecture on medicine and a visit for each student at a Swedish institution engaged in his/her field of interest. On the return flight they stopped in London for three days to visit the U.S. Army, Navy, and Air Force Research Offices.

Loveridge, from Lafayette, Ind., is currently studying engineering at Purdue University. His ISEF exhibit was titled "A Study in the Restoration of X-Irradiation Damaged Lymphoid Tissues in Mice, using Deoxyribonucleic Acid." Loveridge received from the Army a Superior Award Medal and a Certificate of Achievement, as well as the trip to Stockholm.

Loveridge holds membership in the National Honor Society and was part of the 1972 U.S. delegation to the International Youth Science Fortnight in London, as a winner in the U.S. Army and industry sponsored National Junior Science and Humanities Symposium at Durham, N.C., last May. He was designated an Outstanding Teenager of America for 1972.

Navy selectee Cindy Lindsay's ISEF exhibit was titled "Voluntary Heart-Rate Variation and its Correlations to Alpha Brain Waves." Air Force representative Van Wedeen displayed "Automation of Differential Equations."

The escort party for the students consisted of Mrs. Dorothy Robinson, Office of Naval Research, and Mrs. Dorothy Schriver, assistant director of Science Service, a nonprofit institution which sponsors the annual ISEF competition.

Serving as American goodwill ambassadors, Claire M. Fritsche and Corey Jon Mullins recently traveled to Japan for a 7-day visit in Tokyo as winners of the "Operation Cherry Blossom" Award at the 23d International Science and Engineering Fair (ISEF).

Operation Cherry Blossom, as the annual trip to Japan is known, was inaugurated in 1963 and has continually earned the warm-heated response of the Japanese people. The official escort party for the duo included LTC Jeanne Sanford, Walter Reed Army Medical Center, and Howard L. Weisbrod, Science Service representative, ISEF sponsor.

Miss Fritsche was the U.S. Army selectee for the award. Mullins was chosen by General Motors Corp., which participated in Operation Cherry Blossom for the first time. Army winners at the ISEF were selected by 22 judges, including 10 Army Reserve officers and 11 from Army R&D laboratories.

Purpose of the Tokyo trip was attendance by the students at the Japan Student Science Awards Exhibit. Fritsche and Mullins presented photographic displays of their ISEF projects and received special medals and commendations from the Japanese newspaper, *Yomiuri Shimbun,* the exhibit sponsor.

This year's winners were graced by the personal congratulations and a chat with Their Highnesses, Prince and Princess Hitachi—members of Japan's royal family. Also in attendance was COL John D. Marshall Jr., commander U.S. Army, R&D Group, Far East, and LTG Welborn G. Dolvin, commander, U.S. Army Japan.

As guests in Tokyo, the students spent one night with Japanese families which were selected by the *Yomiuri Shimbun.* Other scheduled activities included sightseeing in Tokyo, a visit to the famed Kabuki Theater, tours of the Nikon Camera Factory and the Yomiuri newspaper facilities.

The students also visited the U.S. Embassy with U.S. Ambassador Robert S. Ingersoll and Science Attache Robert Hiatt. A tour of HQ U.S. Army Japan was also provided. The return trip included an overnight stop in Honolulu, Hawaii.

The award winning exhibit of Miss Fritsche was titled "Preventing Ozone-Induced Injury of 'P. vulgaris' With Alpha Tocopherol." She is from Milwaukee, Wisc., and is currently a freshman at Iowa State University. She plans to become a physician. In addition to winning the Tokyo trip she received a gold medallion as an Army Superior Award winner.

Mullins is from Merritt Island, Fla., and is a freshman at Rollins College, Fla. He plans to enter the field of medicine. His project was titled "An Inorganic Ion-Exchange Membrane for Desalination of Water."

NOBEL PRIZE AWARD ceremonies in Stockholm, Sweden, were viewed by young American science students, as representatives of the Tri-Services. From left are Van Wedeen (Air Force), Harold Loveridge (Army), and Cindy Lindsay (Navy).

OPERATION CHERRY BLOSSOM winners Corey Jon Mullins (General Motors Corp.) and Claire M. Fritsche (Army) are greeted by Their Highnesses Prince and Princess Hitachi, at the recent Japan Student Science Exhibits Awards ceremonies.

The Case for U.S. Leadership in Technology

(Continued from inside front cover)

dition. We had the Garand Rifle, which was better than the other armies had; however, our enemies had better artillery, tanks and aircraft. At that time, our technology base was in academia and industry, and not focused on military needs.

Fortunately, we had the time and money to convert this technology base. Our industrial capacity eventually became the dominating factor. The German 88mm gun, tank, V-1 and V-2 missiles and jet fighter planes are some examples of technologically superior equipment fielded by our enemy, which we had to offset with sheer quantities of supplies and less efficient equipment.

In the future, we will not have the time nor the wealth to repeat this method of operation. We must have the technological base with the capability to design new equipment as needed, and the industrial base to produce it in quantity when needed.

One hears much these days, however, about whether our "priorities" are correct and whether defense spending is detracting from our ability to retain a strong domestic economy—as if they were separable! Our nation does not face a choice, nor does it have the option to choose, between a strong defense posture or a strong domestic economy. One strength is dependent upon the other; they are mutually supportive and cannot be separated or treated as competing options.

Another "priority" discussion revolves around whether social and domestic economic goals are being hurt by defense spending. Let's look at a few facts in this regard. In 1968, at the peak of Vietnam, social and economic spending exceeded defense spending. Since that time, defense spending has remained essentially level while social and economic spending has increased by more than 50 percent and is now almost double that for defense.

Another example concerns industrial production. In 1968, at the height of the war in Vietnam, our industrial production output was about equally divided for support of defense, consumer goods, and equipment for business. Since that time, defense production has dropped drastically. Production of equipment for business is about what it was four years ago. Production of consumer goods has increased significantly; it is 20 percent more than for equipment for business, and 63 percent more than for defense.

It appears to me that "priorities" have already been reordered. Indeed, fiscal prudence dictates that considerable attention must be paid now to securing control over social and economic spending.

The Right to "Pursuit of Happiness." In the pursuit of Happiness, many factors are not directly affected by technology: our individual choice of religion, our selection of a mate, and usually our choice of occupation or profession.

Technology does impact on where we live, if we must have employment and the comforts we want—TV, car, hi-fi, communications, recreation, etc. Intellectual quality is also affected by technology—the amount of free time we have, the availability and choice of transportation for travel, and a host of educational opportunities made possible by new communications equipment.

It is clear, therefore, that technology is available and can help us in the pursuit of Happiness. But to use it, the question is: Can we afford it? Technology is available to India, Uganda and a host of other countries, but at present they can afford only a fraction of what we can.

The reason we have been able to afford it so far is that a combination of technology and capital investment has provided us a very high level of output per man-year of effort. We were also able to sell many things abroad in order to buy things both in this country and out of this country.

We are now witnessing a significant change in international markets. We can no longer competitively market to other countries those items which include high labor costs. In fact, the reverse is true, as is evident from the following examples: 9 of 10 U.S. home radios are imports; half our shoes are imports; half our black and white televisions are imports; 96 percent of our motorcycles are imports; 9 of 10 baseball gloves are imports; and 8 of 10 tennis racquets are imports.

Since we can no longer afford to export raw materials, because of their scarcity, that also has changed the pattern. Therefore, if we are to maintain a position of prominence, without lowering our standard of living, it can only be done by producing and exporting high-technology items, which also requires superior technology for production.

What then is the prospect for staying ahead in technology? It's not going to be easy. Take the USSR for example. It appears that technology in the USSR has been moving ahead at a rate faster than ours in all fields except agriculture. This is particularly significant because of two reasons: first, most basic technology has application for economic growth as well as military use; and second, the USSR has a large market for its manufactured products, which is not available to us, and at the same time has access to the world markets that we have.

The growth of technology in Japan and Germany, combined with the fact that they had to replace so many war-damaged capital facilities with modern, more efficient equipment, which has made them formidable competitors.

In my opinion, we can handle this technology challenge. Furthermore, the government is determined not to apply technology just to the items that increase our capability for continued economic growth, and hence provide the wherewithal for Life and the pursuit of Happiness. This has resulted in FY 73 spending on technology more directly related to such pursuits in the amounts shown:

- $451 million in safe, clean transportation research and development (up 46 percent since Fiscal Year 1972);
- $136 million in research and development to reduce loss of life and property from fires, earthquakes, storms, floods and other natural disasters (up 46 percent);
- $197 million to advance education R&D (up 39 percent);
- $430 million for cancer research (up 22 percent);
- $393 million for clean energy research (up 22 percent);
- and, $2.3 billion (up 12 percent since 1972) for R&D in universities—the "Fountain of Youth" for our technology.

Since we have lived with advanced technology longer than most nations, we have been the first to experience the ill effects it brought on our environment. However, I would point out that our choices, in the selection of which portions of technology we employed, contributed greatly to our present condition. Other portions of technology are available to alleviate and improve conditions in the future, with important effects both on Life and the pursuit of Happiness. I think there is no question about our desire to solve our environmental problems and to help other nations solve theirs since, in the final analysis, there is only one large environment in which we all live.

Why Leadership? Having discussed how technology has aided us, and will continue to aid us, in achieving the rights of Life, Liberty and the pursuit of Happiness, the question remains, however—why must the United States maintain a position of leadership in technology?

Since most of us want to retain at least as much as we have, and we want to improve our lot as much as possible, it is apparent that Life and Liberty are intertwined; and in both areas it is in our best interest to be militarily and economically strong. This does not mean that we need to be the best or the biggest to insure a certain freedom of choices, but it does mean that the United States must be among the world leaders.

Life and the pursuit of Happiness are also intertwined because of our material and intellectual wants and the desire to avoid or reduce the effects of natural disasters. We all want a better, longer, and more satisfying life than our ancestors lived. This is possible only if we are one of the world's leaders in technology, and can afford to produce and buy the goods and services which allow us to reach these goals.

In a 1968 issue of *LIFE* Magazine, there is an excellent picture of the Earth taken from Apollo, and beneath the picture is a poem by James Dickey. One phrase from that poem is: "And behold—the blue planet steeped in its dream." Whether we like it or not, there is only one world; and the United States is a part of this world.

A selfish viewpoint dictates that we can insure that this world remains a place on which we can live only if we have a significant voice in world affairs. For moral reasons, we are obligated to contribute our knowledge and talents to improve life on this planet. We can make contributions only if we remain one of the world's leaders in technology.

AMMRC Studies Polyphosphazenes in New Materials Research

By Dr. Robert E. Singler and Dr. Gary L. Hagnauer
U.S. Army Materials and Mechanics Research Center

Studies of polyphosphazenes, a class of inorganic polymers, are receiving continued interest by the Army and other government agencies following recent developments at the Organic Materials Laboratory, U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass.

Scientists reported on the progress of developing the polymers for new materials during a recent Military Theme Review at the Army Research Office in Durham (ARO-D), N.C. The AMMRC scientists feel that successful synthesis of stable polyphosphazenes (high-molecular-weight polymers with a phosphorus-nitrogen backbone) is one of the most important developments in the field of inorganic polymers since the commercialization of silicones.

Earlier work on polyphosphazenes in synthetic rubber research at AMMRC was reported in the April-June 1971 issue of the *Army R&D Newsmagazine,* p. 56. In the current research, Dr. Robert E. Singler and Dr. Wenzel E. Davidsohn noted that the Army has a continuing need for materials with improved properties that can be retained over long periods.

The Army's initial interest in polyphosphazene fluoroelastomers was to develop rubbers with adequate strength, fuel and oil resistance, and low-temperature flexibility for numerous fuel handling equipment items serviceable below −70°F. This development work has indicated that polyphosphazenes may be suitable for an even wider variety of elastomer applications as well as for plastics, fibers and lubricants.

The work at AMMRC is designed to gain a better understanding of the chemistry of polyphosphazenes and to determine how these materials can be best utilized. AMMRC's in-house research program has three major goals:

- Synthesis of new phosphazene polymers and investigation of their properties.
- Elucidation of the molecular structure of phosphazene polymers.
- Investigation of the mechanism of phosphonitrilic chloride polymerization.

The synthesis of phosphazene high polymers is one of the most attractive features of the system. With most other polymer systems, different monomers must be used in the makeup of the polymer backbone; however, the properties of polyphosphazenes can be varied extensively by using the same polymer synthesis:

$$(Cl_2PN)_3 \xrightarrow[\text{vacuum}]{240°C.,\ 50\ hr} (Cl_2PN)_n$$

where n = 15,000 units

The next step, substitution of cholorine by various organic ligands, determines the physical properties of the polyphosphazene:

$$(Cl_2PN)_n \xrightarrow{RONa} [(RO)_2PN]_n$$

Both fluoroalcohols and phenols have been used in this second step to obtain elastomers, plastics, and fiber-like materials. Dr. Singler, Bernard LaLiberte and Richard Matton are investigating the extent to which synthetic variations affect the properties of polyphosphazenes. New polymers are being prepared, and their properties are being studied.

Material properties such as elasticity, tensile strength, and processibility are functions of the structure of polymer molecules. To characterize the macromolecular structure of polyphosphazenes, Dr. Gary Hagnauer and CPT William Cross use techniques such as light scattering, viscometry, osmometry, and gel permeation chromatography.

These AMMRC scientists are also fractionating selected polyphosphazenes in order to evaluate dependence of fundamental material properties on the molecular structure and molecular weight.

Complementary investigations by Dr. Nathaniel Schneider, Abraham King and Dr. Robert Sacher of AMMRC are also under way. Work needs to be done to determine better how thermal stability, glass transitions and melting temperatures are related to chemical and molecular structure. The morphology of these polymers needs to be examined in further detail. These studies will help determine what conditions are necessary for producing optimum molecular structure for particular applications.

The mechanism of phosphonitrilic chloride polymerization is still a subject of controversy. Reproducibility of the polymerization and subsequent substitution reactions will be necessary for the large-scale development of polyphosphazenes. Although AMMRC scientists have successfully prepared these polymers, they hope to learn more about the polymerization mechanism in order to control polymer properties better.

Important work on polyphosphazenes is being conducted at several other laboratories. Prof. H. R. Allcock of Penn State University described his investigations on the synthesis, degradation, and structure of polyphosphazenes at a seminar during the ARO-D Military Theme Review held at AMMRC in 1972. His investigations, which have been important in the development of polyphosphazenes, are supported by ARO-D.

Polyphosphazenes have been under development as low-temperature rubbers for AMMRC under contract since 1968 at Horizons Research, Inc., Cleveland, Ohio. Under the direction of Dr. Selwyn Rose and Dr. Kennard Reynard, three very promising candidate polymers have been synthesized:

$[(CF_3CH_2O)_2PN - (C_3F_7CH_2O)_2PN]_n$
$[(CF_3CH_2O)_2PN - (HCF_2C_3F_6CH_2O)_2PN]_n$
$[(HCF_2CF_2CH_2O)_2PN - (HCF_2C_5F_{10}CH_2O)_2PN]_n$

These elastomers have glass transition temperatures of−70° to −100°F., excellent fuel and oil resistance, and nonflammability. Thermal analysis and ageing studies show good thermal stability above 300°F. Excellent resistance to strong acids and bases has been obtained. Tensile strengths are generally above 1500 psi, and—in conjunction with Firestone Central Research Laboratories—tensile strengths above 2000 psi have been achieved.

Due to the excellent thermal stability and oil resistance of the polyphosphazene fluoroelastomers, these materials are being evaluated for oil seal applications. Under the direction of AMMRC and Aviation Systems Command (AVSCOM), polyphosphazene fluoroelastomers are being synthesized and compounded by Horizons, Inc., for the UH-1 helicopter main input transmission seal.

The material prepared so far looks promising for seal applications, especially in regard to retention of physical properties during ageing studies. As part of this program, additional compounding studies of polyphosphazenes are being conducted by Angus Wilson at Natick Laboratories.

Horizons, Inc., is now supplying Federal Mogul Corp., Rubber and Plastics Division, with polyphosphazene rubber for fabrication into helicopter transmission seals. If fabrication is successful, the UH-1 transmission seals made from polyphosphazene rubber will be tested at a later date.

Polyphosphazenes have been synthesized by Horizons and evaluated as inexpensive, flame-resistant wire coatings in ship applications through AMMRC for the Naval Ship Engineering Center. Several poly(aryloxy)phosphazenes have been prepared which look suitable for Navy ship applications and other uses such as gas mask components:

$[(C_6H_5O)_2PN]_n$
$[(p\text{–}ClC_6H_4O)_2PN]_n$

$[(m-CH_3C_6H_4O)\ PN]_n$

The properties of these polymers are quite different from the phosphazene fluoroelastomers. They are highly crystalline and show good potential in thermoplastic applications. Other government support of polyphosphazene development includes NASA's interest in aerospace applications and Naval Air Systems' interests in O-rings and gasket applications.

Although a number of applications are foreseen, AMMRC is presently concentrating development efforts on elastomer applications. During this year these promising polyphosphazene fluoroelastomers will be advanced to a stage where evaluation for various low-temperature applications will become feasible. Curing mechanisms are being developed which give optimum low temperature properties.

Compounded and uncompounded specimens of these polymers will be examined for suitability for extreme environment service by various tests. Measurement of tensile strength, percent elongation, modulus, brittleness temperature, barrier properties, percent swell, and abrasion resistance will allow a more complete evaluation of the capabilities of phosphazene fluoroelastomers for low temperature applications.

For the next step in the development of polyphosphazenes, AMMRC has proposed a program for the production of phosphazene elastomers in FY 74. The objective will be to scale up existing production methods to produce 100-lb. quantities of the desired polyphosphazenes. Production on a large scale will significantly reduce the cost of polyphosphazenes.

Once an adequate supply of material is available, fabrication into end items and in service evaluation of these items with Mobility Equipment R&D Command (MERDC) and other government agencies is planned. Items to be tested include hoses, gaskets, fuel tank sealants, gun pads, potting compounds, coatings, gas mask components, and other rubber applications.

The work on polyphosphazenes is considered a breakthrough in the development of elastomers, and AMMRC researchers anticipate that this class of materials will be applied to many important Army needs.

Army Commands Receive Value Engineering Awards

Four major U.S. Army organizations received Commendation Awards in December for outstanding achievement in the reduction of costs through Value Engineering (VE).

The awards were presented by Army Comptroller LTG John M. Wright, Jr. in a ceremony at the Pentagon. GEN Wright has over-all responsibility for the Army Value Engineering Program.

Value Engineering, he said, has never been so necessary to the Army as a vital tool to reduce costs when defense dollars are being reduced. He praised the award-winning organizations and their workers in the field who actually produced the savings through the use of VE techniques.

Award-winning organizations and their achievements are: Office of the U.S. Army Safeguard System Manager, which received 41 contractor-initiated VE change proposals and originated 86 in-house VE proposals that resulted in savings of $46 million in Fiscal Year 1972, over 460 percent of their goal.

The U.S. Army Corps of Engineers received 261 contractor-initiated VE change proposals and originated 129 in-house VE proposals. They resulted in savings of more than $19 million in FY 72, exceeding their goal by 194 percent.

The U.S. Army Materiel Command received 600 contractor-initiated VE change proposals and originated 1,365 in-house proposals. Savings of $102 million in FY 72 exceeded the AMC goal by 173 percent.

The U.S. Army Security Agency received six contractor-initiated VE change proposals and originated 19 in-house proposals that resulted in FY 72 savings to the Army of $4.7 million, more than 472 percent of their goal.

RECEIVING Commendation Awards for outstanding achievement in reducing costs through Value Engineering at four major U.S. Army organizations are (from left) LTG Walter P. Leber, SAFEGUARD Systems manager; MG A. P. Rollins Jr., Office of the Chief of Engineers; LTG John M. Wright, Army Comptroller, who presented the awards; MG John R. Guthrie, AMC; BG George McFadden, Army Security Agency.

ACSFOR Replaces OCRD As OR Symposium Sponsor

Sponsorship of the Twelfth U.S. Army Operations Research Symposium, scheduled Oct. 3-6 at Durham, N.C., will be the responsibility of the Army Assistant Chief of Staff for Force Development for the first time.

Transfer of sponsorship from the office of the Chief of Research and Development was announced by OACSFOR in mid-January, but the U.S. Army Research Office, an element of OCRD, will continue as host, a role in which ARO-D has functioned since the inception of the symposium.

The theme of the 1973 meeting is "Operations Research and the Army of the Seventies," prompted by recent changes to the systems acquisition process, the increased emphasis on operational test and evaluation, and the reorganization of the Army in the continental United States.

Nonconcurrent general sessions are scheduled in addition to presentations of technical papers and discussions in working groups in the areas of: OR in the Systems Acquisition Process; OR in Force Planning; Operational Testing and Army OR; Weapons Effectiveness; Costing; Resources Analysis; Logistics; Industrial Process; Analytical Models; Hierarchy of Models; and Model Validation.

Solicited and contributed papers will be presented at the general sessions. Contributed papers for the general sessions may be in any area of OR or systems analysis, but should be of "general interest to the Army OR practitioners," the arrangements committee has announced.

Abstracts of technical papers for presentation to either the general sessions or the working group sessions should be marked for the area intended (general or working group) and forwarded by Mar. 15 to: HQ Department of the Army, Office of the Assistant Chief of Staff for Force Development, ATTN: DAFD-ZAA, Washington, D.C. 20310.

Chemical Demilitarization Centralized

Centralized management for the demilitarization of lethal chemical agents and munitions is the purpose of the recently established Office of the Program Manager for Demilitarization of Chemical Material, Picatinny Arsenal, Dover, N.J.

Supporting this mission are pilot operations and developments at Edgewood Arsenal, Md.; disassembly and safing mechanisms at Tooele Army Depot, Utah; and converted production facilities at Rocky Mountain Arsenal, Colo. Liaison offices are slated for Fort Detrick, Md., and Joliet, Ill.

Environmental impact statements have been submitted and approved for actual demilitarization work. Procedures used are under examination by civilian agencies for potential application to national waste problems.

New Materiel Introduction Team Provides Guidance For Field Testing U.S. Army Counterintrusion Systems

NMIT team members (from left) include SFC Walter Gale, SFC Bueford Hensley, MSG Marvin Scott, CWO Odis M. Smith, SFC Everett N. Brown, SSG Clarence Speigner, and SFC Raymond P. Yates. The team, 26-members in all, operates worldwide in testing and evaluating U.S. Army counter-intrusion systems.

What Army unit regularly sends the same soldier to such distant places as Hawaii, Alaska, or Germany in less than half a year? One answer is the New Materiel Introduction Team (NMIT), operating out of the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

Since the team was founded in 1967 to coordinate the field testing and evaluation of counterintrusion systems, it has traveled more than 1.5 million miles throughout the world; and its duties have expanded to include the training of personnel in the use of such systems as well as providing professional guidance in installation and use of the gear at field sites.

The NMIT consists of CW3 Odis M. Smith, 24 senior NCOs, and a clerk. Team members are seasoned soldiers who have great technical ability.

The war in Southeast Asia led to the development and fielding of a whole family of tactical sensors. (See January-February 1972 issue of the *Army R&D News Magazine*, p. 14). These devices include components of an interior physical security system as well as a wide range of cost-effective perimeter sensors.

NMIT members demonstrate (from left) the PORTABLE, which monitors FM signals from detection devices; a Dispensable Seismic Intrusion Detector; and a MICROSID hand-emplaced seismic intrusion detector.

CW3 Smith speaks proudly of his men, who have performed their assignments in an outstanding manner all over the globe. Their work has earned them many letters of commendation and appreciation as well as service awards.

In addition to the sensors for interior and physical security, the NMIT handles special-purpose systems for the detection of personnel, vehicles, explosives, weapons, and aircraft.

The NMIT is ready, willing, and able, CW3 Smith boasts, to lend its help to any Army or other government agency. A letter addressed to Commander, USAMERDC, ATTN: SMEFB-XA, Fort Belvoir, Va., will set the team in motion.

Army Reviews Stinger Program To Update Operational Concepts

Top management people concerned with development of the Army's new shoulder-fired Stinger air-defense system convened at Redstone (Ala.) Arsenal to see how the program is doing and make plans for where it is going.

"We're evaluating the complete Stinger program, its people, equipment, resources and management controls," said COL David H. Souser, Stinger project manager. "We're bringing the development team up to date on progress we've made, we're looking for ways to control costs, and we're taking a close look at program objectives such as testing, training and operational concepts."

About 75 people attended the Quarterly Review session, including representatives from agencies throughout the Army and industry.

Stinger, which incorporates the latest in infrared technology and utilizes research evolving from several years of development efforts, is being developed to counter more sophisticated aircraft threats.

Able to kill maneuvering targets in a heavy countermeasures environment, Stinger will counter the high-speed, low-level jet attacker and will be a lethal weapon against helicopters, observation aircraft and transports.

Experts Discuss Intelligence Concepts At Series of CDCINTA Conferences

Army and Air Force intelligence collecting methods over the next 14 years were discussed at a recent series of conferences at the U.S. Army Combat Developments Command Intelligence Agency at Fort Huachuca, Ariz. More than 40 intelligence experts attended.

The conferees discussed intelligence concepts, the family of Army surveillance and target acquisition requirements, tactical moving ground target detection systems, and the evaluation of tactical intelligence collection tasks.

COL David A. Ownes, agency commander, announced that continuing studies through the current fiscal year are designed to provide the Army with data that can be used to enhance the combat field commander's detection and surveillance capabilities.

Automotive Design Analysis . . .

TACOM Develops 'Motion Simulator' for Human Vibration-Response

By William F. Lins

Ride characteristics of cross-country vehicles that may prove useful to automotive design engineers can be evaluated effectively with a new human vibration-response measuring device developed by the U.S. Army Tank-Automotive Command, Warren, Mich.

Expected to prove useful for civilian as well as military vehicle applications, a vibration theory was developed by Dr. R. A. Lee and Fred Pradko, engineers in the TACOM Research, Development and Engineering Directorate.

This theory on which the instrument is based is that physiological and psychological responses of an individual to an environment of vibration are related directly to the rate of energy flow to the body.

Known to the researchers as "absorbed power," this parameter is a function of the anatomical properties of the subject. For example, a muscular person generally absorbs less power than a flabby person of the same weight when subjected to the same vibration.

The new instrument, developed for field testing of tactical or combat vehicles, consists essentially of three units—a small electronic computer, a power supply to operate the computer, and an accelerometer that, measures shock and vibration. The test rider sits on the accelerometer, which is taped to the driver's seat.

Two motion simulators were used in an experimental program of more than 1,400 hours of vehicle operation to investigate vibrational responses of 31 volunteer subjects. Data obtained were analyzed and averaged to derive a computerized mathematical model describing the response characteristics of a 28-year-old male with a seated weight of 150 pounds.

PFC Stephen A. Drosjack gets behind the wheel of a jeep equipped with the mobile "absorbed-power" meter. The accelerometer, shown on the driver's seat, measures the travel shock and vibration accelerations. The data is fed into the small electronic computer which is the box on the left of the passenger's seat. The box on the right is computer power supply.

WILLIAM F. LINS is a mechanical engineer with the Surface Mobility Division, U.S. Army Tank-Automotive Command (TACOM). Before joining TACOM in August 1967, he earned BSEE and MS degrees in systems engineering from Washington University, St. Louis, Mo., while working for the McDonnel-Douglas Corp. He is presently studying bioengineering at Wayne State University, Detroit, Mich.

These empirical mathematical relationships provide a basis for assessing the severity of a given vibration in terms of human response. Absorbed power values calculated from these functions represent a quantitative measure of the level of discomfort produced by a given vibration in the "average" young male.

The mathematical representation of the human is contained in the electronic circuits of the vibration-response measuring instrument. By properly shaping the input acceleration and squaring the output, absorbed power is derived. Because of the portable nature of the device, miniature electronic components are used.

When operating a vehicle under severe environmental conditions, the human operator is usually the weakest link in the performance of a vehicle system. Many types of external conditions can cause an impairment in the manner in which the operator controls the vehicle. One of these is whole-body vibration. The effect of this vibration on the human operator falls into two predominate areas: physiological and psychological. Both are related but little is known about the interaction between them.

Perhaps not coincidentally, the weak link in the methodological apparatus available for analyzing the performance of driver-vehicle systems is also in the human factors area. The laws of mechanics allow us to represent the vehicle subsystems mathematically in order to describe accurately their response to a control or disturbance input function. However, there are no comparable quantitative laws describing the influence of the resultant vehicle motions of the physiological or psychological functions of the operator and other vehicle occupants.

When an individual is subjected to a vibratory environment, he forms an opinion of that vibration. This is a subjective response, or psychological impression, which is related to the person's mechanical response to the vibration. It is customary to speak of a specific vibration as being comfortable, unpleasant, severe or intolerable. Obviously, these descriptions mean different things to different people.

Attempts to characterize vibration severity objectively usually involve measurements of the acceleration to which a subject is exposed. Such measurements cannot be simply correlated with subjective response because perceived vibration severity is a complicated function of both frequency and amplitude of vibration.

The TACOM-developed accelerometer consists of a double cantilever beam mechanism with gauges mounted to measure strain proportional to the acceleration applied. Damping is provided by filling the accelerometer with a fluid of the desired density and viscosity.

The accelerometer fulfills the following requirements:

- It has high sensitivity so that the electronic circuitry does not require excessive operational amplifier gain.
- The frequency at which the accelerometer resonates is above 100 Hertz, so the signal distortion does not occur at higher frequencies of interest.
- It has low sensitivity to temperature and a low profile, since the subject is required to sit on the accelerometer.

The three output parameters provided by the device are instantaneous acceleration into the subject, instantaneous absorbed power, and average absorbed power, allowing a wide range of vibrational levels for evaluation.

One of the uses of the instrument is to verify laboratory vehicle simulation tests. For example, if a suspension system design change is required to reduce the severity of a cross-country vehicle, TACOM engineers can conduct simulation tests in the laboratory on a wide variety of suspension system modifications.

When the right suspension design is found, it is possible to evaluate the system under actual field conditions, using the data obtained with the absorbed-power meter to validate the laboratory test results.

With the absorbed-power meter, we can obtain a standardized measurement to ride severity after running only one field test. It is no longer necessary to run additional field tests and average out human responses. That has already been done in the laboratory.

The mathematical model of the 150-pound-man used in the meter contains the average responses gathered in the motion simulation studies. So now we know that this one level of absorbed power obtained in one field test indicates a specific severity level.

Although the instrument measures absorbed power in the vertical direction only, a 3-dimensional device for measuring absorbed power in the vertical, fore-aft, and side-to-side direction is now under construction. This could further assist automotive engineers in designing car seats and suspension systems for cross-country vehicles.

Conferences & Symposia . . .

Army Solid Mechanics Symposium Examines Improved R&D Design Efforts

Ways of making mechanics research efforts more responsive to requirements in design of advanced military systems were examined at the recent Third Biennial U.S. Army Symposium on Solid Mechanics.

Nearly 200 participants, representative of the Army, Navy, Air Force, National Aeronautics and Space Administration, 15 universities or research institutes, 20 industries and 4 foreign countries, exchanged information and views at the 3-day meeting in Ocean City, Md.

Sessions were sponsored by the Technical Working Group for Mechanics of Materials, one of nine TWGs of the U.S. Army Materiel Command Materials Advisory Group, with Dr. Alvin E. Gorum presiding as chairman. Dr. Gorum is director of the Army Materials and Mechanics Research Center, Watertown, Mass.

Scientific Director of Army Research Dr. Ivan R. Hershner Jr., newly appointed to that position following 15 years of continuing key assignments with the Army Research Office, presented the opening address.

Military materiel, he emphasized, must be designed to achieve superiority on the battlefield but simple enough to assure minimum initial production costs without sacrificing ruggedness and durability. He spoke at length on RAM (Reliability, Availability and Maintainability) of materiel.

In discussing RAM, he said that the cost of an average weapon system life cycle is distributed 10 percent for research and development, 30 percent for system production, and 60 percent for operation and maintenance. Fostering of an effective environment of an interdependent relationship of the research scientists and engineers, the developer and the user is essential, he said.

Dr. Hershner concluded by expressing his confidence in the recently established AMC Lead Laboratories in the areas of mechanics, materials and ballistics. In his view, they will have significant impact in advancing the technology base required for future weapons systems, and on meeting the challenge of developing cost-effective systems despite continued inflation of prices.

Paul F. Yaggy, director, U.S. Army Air Mobility R&D Laboratory, Moffett Field, Calif., spoke on designing aircraft for safety and survivability.

Designers must develop better ways of protecting aircraft crews from forces trying to prevent them from accomplishing their mission, Yaggy said, and of providing crewmen with a reasonable chance of survival should the aircraft fail to resist enemy attack.

Yaggy emphasized that safety and survivability must be considered in the initial design phase of any military system. He cited R&D survivability, enhancing efforts involving threat analysis, reduction of detection, and reduction of vulnerability. Safety enhancing efforts included considerations of in-flight operation, structural crashworthiness, and fire prevention.

In closing, Yaggy called for further exploitation of entirely new concepts in such fields as propulsion, engine placement, ballistically tolerant materials, and transparent armor materials.

Keynote speaker Dr. Robert J. Eichelberger, director of the Ballistic Research Laboratories, Aberdeen Proving Ground, Md., identified and evaluated some of the important regions in which the technology of solid mechanics and ballistics overlap.

Dr. Eichelberger projected computer printouts to illustrate his talk. Although viewing computer analysis as a significant element in ballistics work, he cautioned that experimental determination of input data and validation of computer simulations continue to be very important parts of the program.

He explained the major role of solid mechanics in interior ballistics in predicting the capability of rocket motors and gun tubes to withstand pressures ranging to 100,000 psi and over. Projectiles can be designed to withstand very high acceleration and still perform accurately, he said.

Exterior ballistics, he continued, includes the field of aeroelasticity, where there are still problems in simplifying computer codes to present analogs of very complex structures undergoing rapid maneuvers at accelerations of several g's.

"Terminal ballistics provides by far the most fertile territory for work in solid mechanics," Dr. Eichelberger said, "because of the wide variety of phenomena encompassed and the extremes of loading rate involved."

He also discussed missile penetration, hypervelocity impact, projectile-forming devices, and shaped-charge formation. He concluded by identifying the solid mechanics problems that most severely hamper progress in ballistics: computer capacity and software for 3-dimensional problems, the behavior of real materials as opposed to theoretical substance, and the precise definition of the properties of materials.

Seven sessions were devoted to the presentation of 52 technical papers on structural dynamics, clinical problems, penetration mechanics, gun tube technology and ammunition design, fracture and fragmentation, vulnerability, and constitutive relations.

Former Army Chief of R&D LTG Austin W. Betts was the banquet speaker. He is now vice president of the Southwest Research Institute.

The essential purpose of a research institute, LTG Betts said, is to strengthen industry, commerce and agriculture by means of applying R&D results in promoting the general welfare. He cited that not-for-profit research institutes expend only about one percent of the national R&D budget, but have made significant contributions to the postwar growth of American science and technology.

HDL Cosponsors Junior Science and Humanities Symposium

Devices illustrating the applications of electrical and physical theories were among the attractions at the 1972 District of Columbia Junior Science and Humanities Symposium held recently in Washington, D.C.

Jointly sponsoring the symposium were the Harry Diamond Laboratories (HDL), Georgetown University, U.S. Army Research Office —Durham, N.C., and the Washington Junior Academy of Sciences. Objective of the meeting is to promote the study of science and mathematics at the high school level and to assist youth in developing their interests in those fields.

Host to the symposium, Georgetown University, provided on- and off-campus tours including demonstrations of computer technology and pollution indicators. Included in campus seminars were discussions of "High-Power Gas Lasers," and "Oceanography."

Taking top honors for student papers was James T. Barron, a senior at Washington-Lee High School, who presented "Extent and Effects of Noise in Society."

SCIENTIFIC CALENDAR

7th Annual Computer Society International Conference, sponsored by IEEE, San Francisco, Calif., Feb. 27-Mar. 1.

13th Annual Symposium on Fracture and Flaws, sponsored by ASME, ASM and U. of New Mexico, Albuquerque, N. Mex., Mar. 1-2.

Conference on Particle Accelerators, sponsored by IEEE, AEC, NSF and APS, San Francisco, Calif., Mar. 5-7.

3d Sounding Rocket Technology Conference, sponsored by AIAA, Albuquerque, N. Mex., Mar. 7-9.

Conference on Thin Film Phenomena, sponsored by APS and AVS, San Jose, Calif., Mar. 15-16.

Dynamics Specialist Conference, sponsored by AIAA, Williamsburg, Va., Mar. 19-20.

Optical Storage of Digital Data, sponsored by OSA, Boulder, Colo., Mar. 19-21.

14th Structures, Structural Dynamics and Materials Conference, sponsored by AIAA, ASME and SAE, Williamsburg, Va., Mar. 20-22.

13th Symposium on Engineering Aspects of Magnetohydrodynamics, Stanford, Calif., Mar. 26-28.

Physical Electronics Conference, sponsored by APS, Berkeley, Calif., Mar. 26-28.

International Convention of IEEE, N.Y.C., Mar. 26-29.

International Conference on Photonuclear Reactions and Applications, sponsored by ARO-D, NSF, AEC and IUPAP, Pacific Grove, Calif., Mar. 26-30.

1973 Reliability Physics Symposium, sponsored by IITRI, Las Vegas, Nev., Apr. 3-5.

4th Annual Symposium on Environmental Pollution, sponsored by AOA, Edgewood Arsenal, Md., Apr. 4-5.

Southwestern Conference and Exhibition of IEEE, Houston, Tex., Apr. 4-6.

Symposium on Nonlinear Elasticity, sponsored by MRC, Madison, Wisc., Apr. 16-18.

Computer Network Conference, sponsored by AIAA, Huntsville, Ala., Apr. 16-18.

Army Mathematics Steering Committee Examines Latest R&D Applications

Mathematical applications in the R&D field and Army aviation research projects were among topics discussed at the recent 34th semiannual Army Mathematics Steering Committee (AMSC) meeting.

The U.S. Army Air Mobility R&D Laboratory (AMRDL), Ames Research Center, Moffett Field, Calif., was host to the meeting sponsored by the AMSC on behalf of Army Chief of R&D LTG William C. Gribble Jr.

Dr. Ivan R. Hershner Jr., AMSC chairman and scientific director, Office of the Chief of Research and Development (OCRD) and Dr. Fred Frishman, AMSC executive secretary and chief, Mathematics Branch, OCRD, were among the participants.

The AMSC was established in 1956 as the Army Mathematics Steering Group and redesignated with its present title in 1957, with a primary mission to provide assistance to the Chief of R&D (CRD) and other Army staff elements in planning, coordinating and supervising mathematics research of the Department of the Army.

Additionally, it assists in developing the scientific program of the Mathematics Research Center at the University of Wisconsin and provides other DA-funded research groups with guidance and recommendations concerning their programs. AMSC members are appointed by the CRD, based on their training and experience in the mathematical sciences.

Prof. J. Barkley Rosser, director of the Mathematics Research Center, addressed AMSC members and invited guests on personnel changes and scientific activities at the center during the past six months.

Technical reports presented by personnel representing AMRDL laboratories included "General Formulation of Linearized VTOL Response to Random Atmospheric Turbulence," David L. Peters, Ames Directorate; "Mathematics in Turbine Cooling," James Van Fossen, Lewis Directorate; "Mathematical Optimization and its Application to Aircraft Design," D. D. Leondorf, Langley Directorate; "Decision Risk Analysis for R&D Management," John D. Hwang, AMRDL HQ; and "Mathematical Treatment of Two Dimensional Airfoil Data," George L. Kinnett, Eustis Directorate.

Prof. Robert M. Thrall, Rice University, chairman of the In-Science Mathematical Training Subcommittee, discussed suggested topics for future advanced seminars to be held at the Mathematics Research Center. He also reviewed a proposal submitted to the Army by the Society for Industrial and Applied Mathematics (SIAM) for continuation of the publication of a series of expository papers.

A proposed workshop on the Mathematics of Combat Theory and the annual Army Operations Research Symposium were reviewed by Sidney Sobelman, deputy chief of staff for Operations, and chairman of the *Operations Research* Subcommittee.

Dr. Walter Pressman, U.S. Army Electronics Command, *Applied Mathematics and Analysis* Subcommittee chairman, outlined discussions held at the 1972 Conference of Army Mathematicians. Also discussed were plans for the 1973 conference which is to be held at the U.S. Army Training Devices Agency from May 23-25.

Chairman of the *Probability and Statistics* Subcommittee, Dr. Walter Foster, Fort Detrick, reported on his subcommittee's activities. Results of the 18th Army Design of Experiments Conference were reviewed and objectives for the 19th conference were outlined. Hosting the October 1973 conference will be the U.S. Army Weapons Command, Rock Island Arsenal.

Dr. Ronald Uhlig, Army Materiel Command HQ, *Numerical Analysis and Digital Computers* Subcommittee chairman, stressed his desire to place increased emphasis on computers in the mathematical disciplines. Accomplishments of the 1972 Annual Conference on Numerical Analysis and Computers were presented along with suggestions for the 1973 meeting. Neither a date nor a firm location of the conference has been chosen.

LWL Briefs Law Enforcement Personnel on New Techniques

Forty members of the Combined Law Enforcement Intelligence Group (CLEIG) recently visited the U.S. Army Land Warfare Laboratory (LWL) at Aberdeen Proving Ground, Md., for orientation on some of LWL's latest technical advancements.

Made up of civilian police from Maryland and New Jersey and military personnel from the Military Intelligence and Military Police Corps, the group was briefed on Army developments applicable to civil disturbance, law enforcement, security and crime prevention.

They were shown working models of many of LWL's newly developed items. These included short-range simultaneous communications, detection devices for concealed metal objects, riot control vehicles, less lethal ammunition for small arms, automatic personnel verifier and a portable sign-making kit.

Other topics included vapor trace analyzer as explosive detector, rapid detection of heroin, chemical sample detection, radar intrusion detector, building surveillance radar, arms room security, explosive detector dog, narcotics detector dog, multi-purpose dog, variable velocity projectile launcher, all-purpose communications protective helmet, and kindred items.

Of particular interest to the visitors was the walk-through metal detector, a device similar to those being used at commercial airports for the detection of contraband.

U.S. ARMY MATHEMATICS STEERING Committee members and invited guests gathered recently at the U.S. Army Air Mobility R&D Laboratory, Ames Research Center, Moffett Field, Calif., for the 34th semiannual meeting. Pictured (l. to r.) are Dr. Fred Frishman, OCRD; Dr. Ivan Hershner Jr., OCRD; Dr. G. Thomas Sicilia, Office of the Deputy Chief of Staff for Personnel; Prof. H. Solomon, George Washington University; Prof. Robert M. Thrall, Rice University; Douglas B. Tang, Walter Reed Army Institute of Research; Prof. J. B. Rosser, director, Mathematics Research Center, University of Wisconsin; Joseph M. Kirshner, Harry Diamond Laboratories; Dr. John D. Hwang, Army Air Mobility R&D Laboratory (AMRDL); Dr. Walter Pressman, Electronics Command; Lawrence A. Gambino, Army Engineer Topographic Laboratories; Dr. Norman P. Coleman, Army Weapons Command; Miss Alexandra Tolstoy, Combat Developments Command; Dr. Alan S. Galbraith, Army Research Office—Durham (ARO-D), N.C.; George L. Kinnett, AMRDL; Dr. John H. Giese, Aberdeen Proving Ground; Dr. Walter D. Foster, Fort Detrick; Gerard T. Dobrindt, Army Test and Evaluation Command; Dr. Ronald P. Uhlig, Army Materiel Command (AMC); Dr. Badrig M. Kurkjian, AMC; Sidney Sobelman, Office of the Deputy Chief of Staff for Military Operations; COL Lothrop Mittenthal, commander of the Army Research Office.

Career Programs . . .

OTSG Selects Bell for Doctoral Program

LTC John H. Bell has been selected by The Surgeon General's Office for a 3-year training program leading to a doctoral degree in radiation physics at the University of Texas Medical School in San Antonio.

The White Sands (N. Mex.) Missile Range Radiation Protection officer is the only Medical Service Corps (MSC) selectee this year for this training. He will join a group of 41 currently participating in some phase of the doctoral program. Another 123 MSC officers are pursuing master's degrees.

Since its inception in 1947, the MSC has been supporting programs that enable officers to earn advanced degrees. Long-term graduate training is designed to further their formal education, permit them to make more significant contributions to the Corps, and enrich their professional careers.

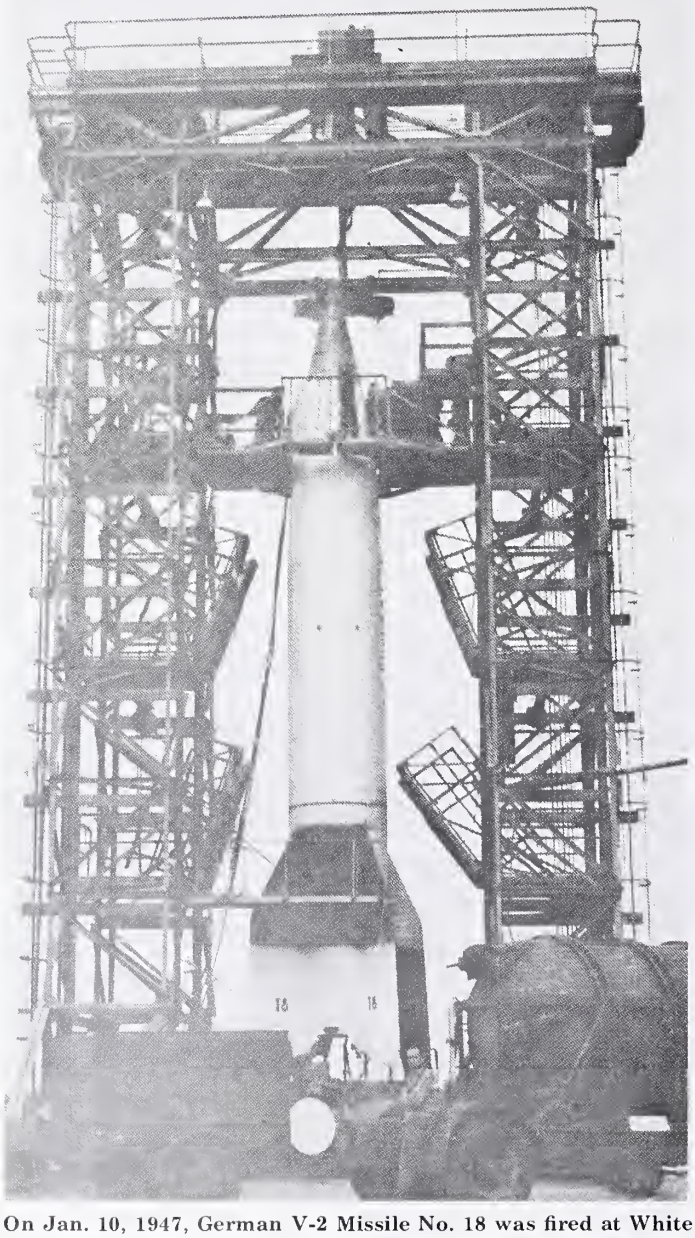
During his tour of duty at White Sands, LTC Bell formulated and administered a radiation protection program under the control of the Radiation Protection Committee. He also wrote or rewrote the local regulations pertaining to radiation protection.

WSMR leaders say he was responsible for obtaining the current licenses from the Atomic Energy Commission (AEC) and the Department of the Army (DA) which allow the use of radioactive materials on the range.

His applications for these licenses, which included the revised regulations and the radiation protection program, caused the AEC and DA to increase by ten-fold the amount of radiation devices permitted there. They also gave more of the responsibility for control of the devices to local personnel.

A report from the U.S. Army Test and Evaluation Command stated: "White Sands Missile Range has improved its radiological program during the past two years, with the result that it is now judged to be the most outstanding program in this command."

In Retrospect . . .



On Jan. 10, 1947, German V-2 Missile No. 18 was fired at White Sands Proving Ground, N. Mex. (now White Sands Missile Range). Here the missile nestles in its gantry near the Army Blockhouse at Launch Complex 33. The gantry still stands. The photo was made available by the WSMR Information Office to the Army Research and Development Newsmagazine through Art Rense of McDonnell-Douglas, Huntington Beach, Calif.

3 MICOM Employes Earn Master's Degrees

Some two years of evening studies under the U.S. Army's advanced education program for career employes recently earned master's degrees for three staff members of the Missile and Munition Center and School, U.S. Army Missile Command, Redstone Arsenal, Ala.

Assigned to the Directorate of Instruction, the employes are Homer Thompson, graduated from Middle Tennessee State; Johnny Nelson and Stanley Jones, both graduated from Alabama A&M University. They received federal assistance because their studies were directly related to their work.

Another employe of the directorate, Larry Veach, received his MA degree from Middle Tennessee State at about the same time as the others, but did not qualify for the Army funding subsidy.

"One of our responsibilities is counseling students," Jones explains. "We are now able to do a better job in our responsibilities to the students."

Reader's Guide . . .

Library of Congress Lists U.S. Resources

More than 2,000 resources are listed in *A Directory of Information Resources in the United States: Biological Sciences,* a 577-page book published recently by the Library of Congress.

The document describes organizations able to respond to specific information needs in various fields relating to the biological sciences. Included are federal, state, and local government activities, information centers, libraries, professional societies, academic facilities, national associations, laboratories, herbariums, museums and other organizations.

A computer-based method of production was employed in preparing the directory. Entries were selected by machine from a composite National Referral Center Publications data base maintained in a format adapted from the widely used Library of Congress Machine-Readable Cataloging (MARC) format.

Paperbound copies may be purchased for $5 each from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. GPO catalog number is LC 1.31:D62/7.

NBS Brochure Explains Electricity Services

Calibration, research and consultive services available from the Electricity Division of the National Bureau of Standards (NBS) are explained in a newly published brochure.

The Electricity Division has the basic responsibility for establishing standards for the electrical units for the nation and making them available to science and industry through calibrations. Services include measurement assurance programs (MAP) for establishing the highest possible accuracy of basic electrical laboratory units; R&D efforts involved in metrological capabilities; design and construction of special instrumentation; and cooperative programs including seminars and training in appropriate aspects of NBS capabilities.

Additional information may be obtained from Dr. C. H. Page, chief, Electricity Division, National Bureau of Standards, Washington, D.C. 20234, (301) 921-2701.

People in Perspective . . .

Chemist Finds Mountain Climbing Adventurous

Climbing the highest mountains in various parts of the world is for Al Tatyrek, a research chemist at Picatinny Arsenal, Dover, N.J., a way of responding to the desire of adventurous men to accept a gruelling challenge to physical and mental endurance.

Tatyrek recently went to Peru to join an expedition of 30 mountaineers to scale the 20,000-foot Mount Contrahierbas. Among his climbing exploits are Mount Kilimanjaro (19,340 feet), subject of one of the late Ernest Hemingway's famed novels; Monta Rosa (15,000 feet), Switzerland's world-renowned Matterhorn (14,700 feet); and numerous peaks in the Rocky Mountains—as well as his primary "stamping ground," the Appalachians.

The Contrahierbas expedition included several members of Tatyrek's Appalachian Club as well as scientists, university professors and members of the National Geographic Society.

The expedition traveled from Lima to reach the base of the mountain, where they were met by parties and pack trains which took them into the Quebrada Ulta region. Each mountaineer was loaded down with about 80 pounds of equipment.

Establishing a base camp at 15,000 feet, the expedition members pitched high-altitude tents and used Coleman stoves for cooking. Despite hardships caused by snow blindness, frost bite, and dysentery, the climbers managed to reach 18,100 feet—some 1,900 feet below the summit.

How does Tatyrek keep fit for these arduous treks? He works out daily in the gym, jogging, swimming and doing special exercises to develop leg muscles and breathing. Tatyrek is also an active scuba diver.

In his spare time, he gives slide lectures on his mountain-climbing exploits to charitable and veterans organizations and civic groups.

SPACEMAN, circa 1934, Wiley Post (1898-1935), one of the most colorful figures of early aviation, also did pioneer research in designing and testing a pressurized suit which helped him establish a series of high-altitude records, in addition to his around-the-world flights in the famed "Winnie Mae" monoplane. Checking Wiley's pressurized suit is Rus Colley, a B. F. Goodrich engineer who helped create this first and possibly strangest ancestor of the space suits now worn by Apollo astronauts in explorations of the moon. Post and his equally famous humorist friend Will Rogers were killed in an August 1935 plane crash.

Picatinny Writer Overcomes Blindness Handicap

Blind since birth, James Gibbons has not let this handicap keep him from obtaining a degree in electrical engineering, which he is using temporarily as a technical writer at Picatinny Arsenal, Dover, N.J.

Gibbons graduated from Rutgers University with a BS degree despite problems in acquiring special equipment and technical Braille books. Using a tape recorder and Braille writer, he performs his present job by transcribing technical writing onto a standard typewriter.

Before being assigned to the Technical Services Directorate at Picatinny, Gibbons was a junior project engineer in the Reliability Engineering Division with Bendix Corp.

The technical writing he is doing is an interim measure pending the availability of a special computer system that translates English into Braille almost instantaneously. Demonstrated recently at the Massachusetts Institute of Technology, this device will enable Gibbons to use computers for his calculations with as much ease as his sighted colleagues.

In the meantime, Gibbons will soon have access to an Optacon, an intricate system which reads printings and provides Braille indentations from the printed page.

Gibbons is one of 300 handicapped persons employed at Picatinny.

Awards . . .

MERITORIOUS CIVILIAN SERVICE. *Dr. Joseph Zeidner* recently received the Meritorious Civilian Service Award (MCSA), the Army's second highest award for civilian employes. The award recognized his services as deputy director for Manned Systems Research, Behavior and Systems Research Laboratory, during 1967-72.

LTG William C. Gribble Jr., Chief of Research and Development, presented the award.

Dr. Charles E. Minarik, former chief of the Vegetation Control Laboratory, Edgewood Arsenal, received the MCSA at his recent retirement ceremony.

An internationally known plant physiologist, he was credited with improving technology in agricultural production for military R&D programs under his supervision.

Ralph H. Allen, U.S. Army Land Warfare Laboratory (LWL), Aberdeen (Md.) Proving Ground, is a recent recipient of the MCSA.

BG Donald R. Keith, director of developments, Office of the Chief of Research and Development, presented the medal and accompanying citation. Allen was recognized for his role in the development of a chemical kit used in determining heroin in body waste fluids.

LEGION OF MERIT. *MG (Dr.) William H. Moncrief Jr.,* CO, Walter Reed Army Medical Center, was presented a second award of the Legion of Merit (LM). He was cited for his services as commander of Letterman General Hospital (1970-72). LTG Hal B. Jennings Jr., Army Surgeon General, made the presentation.

COL (Dr.) Francis C. Cadigan Jr., director of Medical Research, U.S. Army Medical Research and Development Command (USAMRDC), was awarded the LM. He was cited for his outstanding abilities as CO, U.S. Army Medical Research Unit in Malaysia (1969-72). MG Richard R. Taylor, CO, USAMRDC, presented the award.

COL (Dr.) John J. Castellot Sr., MC, recently received the LM for his duties in Vietnam as a medical consultant and chief of Professional Services, Office of the Army Surgeon General (OTSG). The citation also praised his efforts as director of a Drug Operations Center. Col Richard Ross, MC, director of Plans, Supply and Operations made the presentation.

COL Norman R. Rosen was presented the LM at his recent retirement ceremonies for distinguished service with the Office of the Chief of Research and Development (1970-72). He was credited with increasing efficiency and responsiveness of the Army research and exploratory development program. Chief of Research and Development LTG William C. Gribble Jr. made the presentation.

ARMY CHIEF OF R&D LTG William C. Gribble Jr. congratulates Meritorious Service Medal recipient, LTC Thomas C. West, CO, Army Materiel Command Scientific and Technical Information Team, Europe. LTC West was cited for 1970-72 service as acting director and deputy director, Langley Directorate, U.S. Army Air Mobility R&D Laboratory, Hampton, Va. He was responsible for organizing, staffing and managing a joint Army/National Aeronautics and Space Administration research facility. The presentation was made at the United States Army Foreign Science and Technology Center, Charlottesville, Va.

LTC Donald J. Leehey Jr., U.S. Army Test and Evaluation Command, received the LM for exceptionally meritorious performance as chief, Assessment Branch, Plans Division, Directorate of Operations, HQ U.S. Military Assistance Command, Vietnam (1971-72).

MERITORIOUS SERVICE MEDAL. *COL Roger W. Baker,* MC, U.S. Army Natick Laboratories, was recently awarded the Meritorious Service Medal (MSM). He was cited for 1970-72 outstanding performance as special projects officer, HQ USAMRDC, in solving "myriad problems" related to the wholesomeness and safety of irradiated food.

COL James M. Bishop, U.S. Army Test and Evaluation Command (TECOM), received the MSM for exceptionally meritorious service as 1969-72 deputy CO, Frankford Arsenal. BG Samuel W. Koster, TECOM deputy CG and chief of staff, presented the award.

COL Harold J. Stirling, U.S. Army Safeguard Communications Agency (SAFCA), was awarded the MSM for developing engineering design and implementation procedures related to tactical switched communications systems planned for DoD use in the 1980s. GEN Gerd S. Grombacher, CG of SAFCA, made the presentation.

LTC Bernard W. Bruns, U.S. Army Corps of Engineers, received the MSM for 1969-72 service as OCRD engineer standardization representative, U.S. Army Standardization Group, United Kingdom. The citation praised his energetic monitorship of over 70 important projects and recognizing their potential value to the Army.

LTC (Dr.) Hollis E. Bivens, MC, U.S. Army Medical R&D Command, was presented the MSM for 1968-71 service as chief of Anesthesia and Operative Service, Madigan General Hospital. COL Richard F. Barquist, deputy CO, USAMRDC, presented the award.

LTC Louis C. Friedersdorff, OCRD, is a recent recipient of the MSM for 1970-72 service as battalion commander, 3d Battalion, 35th Field Artillery, VII Corps Artillery. The citation recognized his "inspirational leadership and intelligent, resourceful managerial ability."

LTC Henry F. Jonas (Chaplain), OTSG, received the MSM for 1969-72 performance as training officer and staff Chaplain, U.S. Army Medical Command, Europe. He was cited for initiating a progressive program of training for hospital chaplains and assistants.

LTC Sammy J. Cannon, OCRD, received the MSM for service with HQ Modern Army Selected Systems Test Evaluation and Review (MASSTER), Fort Hood, Tex. The citation noted his analytical skill and dedication in MASSTER testing and organizational refinements.

LTC Garrett V. Sidler, OCRD, was awarded the MSM for 1970-72 achievements as CO, 818th Engineer Battalion and executive officer, 931st Engineer Group, Fort Benning, Ga. The citation praised his managerial abilities and professional competence.

LTC Barbara Brady, AMSC, was awarded the MSM for her service as first nutrition consultant on a preventive medicine team during 1971-72. The presentation was made by COL Jerome Greenberg, MC, director of Health and Environment, Office of the Army Surgeon General.

MAJ Byron D. Webb Jr., MSC, Office of the Army Surgeon General, received the MSM for his analytical expertise in managing supply operations and financial allocations for three medical depots in the U.S. Army Pacific area. COL (Dr.) Richard H. Ross, MC, director of Plans, Supply and Operations, made the presentation.

JOINT SERVICE COMMENDATION MEDAL. *CPT Robert F. Sawallesh,* MSC, OTSG, was recently awarded the JSCM for meritorious service (1970-71) while assigned to the Defense Intelligence Agency. COL Raymond E. Adams, MSC executive officer to the Army Surgeon General, presented the medal and citation.

ARMY COMMENDATION MEDAL. *LTC Norman E. Wilks,* MSC, OTSG, recently received a first Oak Leaf Cluster to the Army Commendation Medal (ARCOM). He was cited for service with the Southeast Asia Treaty Organization Laboratories in Thailand (1970-72) as a scientist, executive officer and coordinator of the DoD Drug Abuse Counteroffensive Program.

COL Jerome Greenberg, MC, director of Health and Environment, OTSG, presented the award.

MAJ Mary Jo Singer, AMSC, OTSG, was awarded a first Oak Leaf Cluster to the ARCOM. She was recognized for achievements as chief, Diet Therapy Branch, Food Service Division, Walter Reed General Hospital.

SP5 James Crozier, Fuze Development Branch, Picatinny Arsenal, N.J., was awarded the ARCOM for his work in mechanical fuze development. COL G. M. Montgomery, CO, Picatinny Arsenal, presented the award.

2 Army Physicians Cited for Burn Research

Many of the more than 2,000,000 patients treated annually in the U.S. for serious burns can be grateful to two U.S. Army Physicians honored recently as recipients of 1972 Army Research and Development Achievement Awards.

Army Deputy Chief of Research and Development MG George Sammet Jr. presented the awards to Dr. Arthur D. Mason Jr. and Dr. Robert B. Lindberg in ceremonies at the Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, San Antonio, Tex. Mason is chief of the ISR Laboratory Division and Lindberg heads the Microbiology Branch.

Specifically, they were cited as "key figures in the identification and documentation of burn wound sepsis as the major cause of death in patients with extensive burns. . . ."

The commendation states that they developed a reproducible laboratory animal model of the disease; also, that they discovered and developed an effective means of preventing this life-threatening complication of thermal injury through application of Sulfamylon, which has "significantly reduced the mortality resulting from burns."

Actually, the story of the development of Sulfamylon had its beginning more than a decade ago. The antibacterial cream they discovered for treatment of burnwound sepsis has been in wide use since 1964.

Now the most common treatment for more than 2,000,000 seriously burned patients each year, the medication is credited with substantially reducing the mortality rate of those who have burns over 30 to 60 percent of the body. Formerly over half of these patients died.

Dr. Mason, who received his MD degree from Washington University School of Medicine in St. Louis, has held his present position since completing his residency at Barnes Hospital in St. Louis. He has earned several honors, including the Award for Meritorious Civilian Service, for his outstanding work. He is a member of the American Association for Surgery of Trauma and the American Association of Nephrology, and is a charter member of the American Burn Association. He has authored or coauthored 219 scientific papers.

Dr. Lindberg received his PhD in bacteriology from the University of Michigan where he served as a bacteriologist and an instructor in chemical bacteriology. A retired Army colonel, he served during World War II and the Korean conflict as chief of bacteriology in medical labs and subsequently at Walter Reed Army Institute of Research.

While serving at WRAIR, he helped to develop the Army's jet injector device for mass immunizations. In 1961 he came to USAISR and took his present position upon retirement from the Army. He has authored or coauthored 186 scientific papers and is a member of eight professional societies as well as being adjunct professor in five universities. His military awards include the Legion of Merit and the Bronze Star Medal with Oak Leaf Cluster.

MERDC Gets Commendation for Floating Bridge

Development of an improved floating bridge in the near record time of 33 months, with an expenditure of little more than $3 million, has earned a Department of the Army commendation.

The U.S. Army Materiel Command's Mobility Equipment Research and Development Center (USAMERDC), Fort Belvoir, Va., developed the Ribbon Bridge, which features fast assembly (five times faster than M4T6 and Class 60 bridging now in service). Type classified Standard A, it is scheduled for the first procurement in FY 1975.

MG Stewart C. Meyer, director of Research, Development and Engineering at the U.S. Army Materiel Command (AMC) and MG John C. Raaen Jr., CG of the Army Mobility Equipment Command (MECOM), extended their appreciation in letters to COL Bennett L. Lewis, MERDC commander.

The short developmental period and relatively low cost of research, development, test and engineering investment, the letter states, "indicate that each individual applies professional competence, objectiveness, and sense of development urgency in an outstanding manner."

MICOM Engineers Win Acclaim for 'Smart Bombs'

Two U.S. Army Missile Command civil engineers credited with developing the basic technology for the U.S. Air Force laser-guided "Smart Bombs" have won the commendation of *Aviation Week and Space Technology* magazine for outstanding contributions to aerospace science.

David J. Salonimer and Norman L. Bell, both employed at MICOM HQ, Redstone (Ala.) Arsenal, are cited in the Dec. 18, 1972, edition of the magazine not only for their research to advance the essential technology but for efforts that "inspired the Air Force into adopting the scheme for what has become the remarkably accurate laser-guided bomb."

CWO Earns $795 Through AIAP Suggestions

How far will one man's distaste for the routine and his passion for effciency carry him? Well, for CWO Jerry D. Dickson it resulted in submission of an astounding total of 137 FY 72 suggestions under the Army's Incentive Awards Program (AIAP).

CWO Dickson, assigned to the White Sands (N. Mex.) Missile Range (WSMR), actually had only five of his suggestions adopted, but—at an estimated savings of $17,604 to the U.S. Government and a personal gain of $795 through the AIAP. He was also recognized with presentation of a letter of commendation and a commemorative plaque by MG Arthur H. Sweeney Jr., CG of WSMR.

Suggestions submitted by CWO Dickson for the 1971 and 1972 fiscal years have netted the government more than $22,000. The Vietnam veteran and recipient of eight Army service medals refuses to accept the "routine," explaining: "I'm always asking myself Why—I ask myself why it's got to be done or why it is done in a certain way. I've got to try to find a logical reason behind everything."

CWO Dickson feels that too few people participate in the WSMR Suggestion Program and in similar programs in private industry. As a remedy he is writing a book tentatively titled *How to Make Your Ideas Pay Off*. Hopefully, the publication will stimulate people to formulate new ideas, thus increasing organizational effciency.

Two of the items CWO Dickson has acquired as a result of his lucrative hobby are an entire steer for his freezer and the typewriter he is using to write his book. Incidentally, his suggestions submitted for FY 73 have an estimated savings of $130,000.

WSMR Commanding General MG Arthur H. Sweeney Jr. presents letter of commendation and commemorative plaque to CWO Jerry D. Dickson for outstanding participation in the White Sands Missile Range Suggestion Program during the 1972 FY.

The Virginia Society of the National Society of Professional Engineers (NSPE) selected the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., over five other federal agencies to receive its Government Professional Development Award for outstanding contribution to the advancement and improvement of the engineering profession through employment practices. Here, I. Russell Berkness (center), a Virginia national director, is shown presenting the award to COL Bennett L. Lewis, commander of the center. At right is MG Robert R. Ploger, commander of Fort Belvoir and the Engineer Center. The presentation was made at a recent dinner meeting of the George Washington Chapter of the Virginia State Society.

Personnel Actions . . .

Richardson Nominated Defense Secretary

Elliot L. Richardson

Secretary of Health, Education and Welfare (HEW) Elliot L. Richardson has been nominated to succeed Melvin R. Laird as Secretary of Defense. Richardson has served as HEW Secretary since June 1970.

As Under Secretary of State from 1968–70, he participated in National Security Council (NSC) meetings, and was chairman of the NSC Under Secretaries Committee. He also served as chairman of the Board of Foreign Service, which is responsible for major reviews of the organization and personnel systems of the Foreign Service.

Elected as Attorney General of his home state of Massachusetts in 1966, he established the nation's first state-level organized crime control section. From 1964 to 1966 he was lieutenant governor of Massachusetts and was responsible for coordinating the state's health, education and welfare programs. As U.S. Attorney for his state from 1959 to 1961, he conducted investigations of highway land-taking frauds.

Richardson graduated cum laude from both Harvard College (1941) and Harvard Law School (1947) and served as a law clerk to the late Judge Learned Hand of the U.S. Court of Appeals and the late Supreme Court Justice Felix Frankfurter.

Enlisting in the Army in 1942, Richardson rose through the ranks to the grade of first lieutenant. He served in the European Theater of Operations, going ashore with the 4th Infantry Division on D-Day in Normandy, France, and was awarded the Bronze Star Medal and the Purple Heart with Oak Leaf Cluster.

Raaen Takes Over as WECOM Commander

MG John C. Raaen Jr.

MG John C. Raaen Jr. has been named CO, U.S. Army Weapons Command (WECOM), Rock Island, Ill., following the recent retirement of MG Henry A. Rasmussen.

MG Raaen is a graduate of the United States Military Academy, where he was appointed Cadet Captain and Regimental Supply Officer and received his commission as a second lieutenant in the Corps of Engineers. He also earned a master's degree in physics from Johns Hopkins University. His military schooling includes the Army Command and General Staff College, Fort Leavenworth, Kans., the Industrial College of the Armed Forces, Washington, D.C., and the U.S. Naval Academy Postgraduate School, Annapolis, Md.

He was a participant in the initial assault on Omaha Beach, Normandy, France, during World War II. In addition to several assignments in the U.S. and abroad he has served with HQ U.S. Army, Vietnam, and most recently as CO, U.S. Army Mobility Equipment Command, St. Louis, Mo.

Included among his military decorations are the Silver Star, Legion of Merit with two Oak Leaf Clusters (OLC), Bronze Star Medal with "V" device and two OLC, and the Army Commendation Medal.

Hinrichs Designated as CG of AVSCOM

Newly assigned as commanding general, U.S. Army Aviation Systems Command, St. Louis, Mo., is MG Frank A. Hinrichs. He succeeds MG Fred Kornet Jr., now deputy chief of staff, Logistics, Department of the Army.

MG Hinrichs recently completed a 3-year tour as director of Requirements and Procurement, HQ U.S. Army Materiel Command. Other assignments have included CO, U.S. Army Procurement Agency, Vietnam, and director of Procurement, 1st Logistical Command, U.S. Army Pacific. As executive officer, Personnel Directorate, DA, Washington, D.C., he was credited with improving the Army junior officer retention rate.

His academic credentials include a bachelor's degree in general engineering from Oklahoma A&M College (now Oklahoma State University) and a master's degree in business administration from George Washington University. His military schooling includes the Army Command and General Staff College and the Industrial College of the Armed Forces.

Included among his military honors are the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal with OLC, and the Army Commendation Medal with OLC.

AVSCOM Picks Read as Procurement Director

Director of Procurement and Production, U.S. Army Aviation Systems Command, St. Louis, Mo., is BG William E. Read's new title.

BG Read graduated from the U.S. Military Academy in 1950 and for the past year was district engineer, Tulsa District, U.S. Army Corps of Engineers.

In addition to combat duty in World War II and Korea, he has served two tours in Vietnam—one as commander of a separate task force and one as CO, 15th Engineer Battalion, 9th Infantry Division. He also served as assistant Army attache, Israel; assistant professor of mechanics, USMA; engineer unit commander, Europe; and J-4, Joint Chiefs of Staff, Washington, D.C.

BG Read has an MS degree in civil engineering from the University of Illinois and is a graduate of the Army Command and General Staff College, Army War College and Harvard University's advanced management course. His military honors include the Bronze Star Medal with Oak Leaf Cluster.

Johansen Appointed as AMC Supply Director

BG Eivind H. Johansen

BG Eivind H. Johansen has been named director of Supply, HQ U.S. Army Materiel Command (AMC), Washington, D.C. He formerly was assigned as deputy director of Supply and Maintenance, Office, Deputy Chief of Staff for Logistics (ODCSLOG).

He has served in Vietnam as CO, 593d General Support Group and as chief, Supply Division, HQ U.S. Army. Other key assignments include staff officer, Office, Joint Chiefs of Staff; CO, 5th Supply and Transport Battalion, 5th Infantry Division (Mech,), Fort Carson, Colo.; chief, Plans Division, HQ U.S. Army, Alaska; member, Defense Supply Agency Organizational Task Force, Washington, D.C.; chief, Budget-Purchase-Control Branch, HQ U.S. Army Forces Far East/Eighth U.S. Army; and chief, General Supplies Branch, HQ Eighth U.S. Army, Korea.

BG Johansen has a bachelor's degree in business administration from Texas A&M University and a master's degree in international affairs from George Washington University. He is also a graduate of the Army Command and General Staff College and the Naval War College.

His military honors include the Legion of Merit, Bronze Star Medal, Joint Service Commendation Medal, and the Army Commendation Medal with two Oak Leaf Clusters.

Van Buskirk Commands Ammunition Agency

BG Lawrence E. Van Buskirk recently assumed command of the Army Ammunition Procurement and Supply Agency, Joliet, Ill. He was formerly director for Procurement and Production, Aviation Systems Command, St. Louis, Mo.

BG Van Buskirk received his commission as a second lieutenant in the Ordnance Corps upon graduation from Officer Candidate School in 1943. This was followed by duty in the South Pacific.

Previous tours have included Ordnance Corps, Military Personnel Branch, Washington, D.C.; HQ U.S. Army Ordnance District, Detroit, Mich.; CO, 702d Maintenance Battalion, 2d Infantry Division, Korea;

chief, PEMA Execution Division, Office, Deputy Chief of Staff for Logistics; CO, Red River Army Depot, Texarkana, Tex.; and CO, Taiwan Materiel Agency.

His academic credentials include a bachelor's degree in business administration from Wayne State University and a master's degree in business administration from the University of Chicago. He is also a graduate of the Army Command and General Staff College and the Army War College.

Among his military decorations are the Legion of Merit with Oak Leaf Cluster (OLC) and the Army Commendation Medal with OLC.

McKeen Chosen AMC Procurement Director

BG Chester M. McKeen Jr.

BG (MG designate) Chester M. McKeen Jr. has assumed duties as director of Requirements and Procurement, U.S. Army Materiel Command (AMC). He was formerly DCG, U.S. Army Tank Automotive Command (TACOM).

BG McKeen has served as CO, U.S. Army Procurement Agency, Vietnam; director of Materiel Acquisition, Office, Deputy Chief of Staff for Logistics, DA; and chief, Programs Division, Office of the Assistant Secretary of the Army for Installations and Logistics, Washington, D.C.

Other key assignments include Army representative to the Arms Control and Disarmament Agency, Washington, D.C.; Combat Vehicle Program Manager, Office of the Deputy Chief of Staff for Logistics; Production Planning and Control Officer, Frankford Arsenal; and chief, Fire Control Branch, Industrial Division, Office, Chief of Ordnance.

BG McKeen enlisted in the Army in 1942 and received a commission the following year upon graduation from Officer Candidate School. He has a bachelor's degree in military science from the University of Maryland and a master's degree from Babson Institute. He is also a graduate of the Army Command and General Staff College and the Industrial College of the Armed Forces.

His military honors include the Legion of Merit with two Oak Leaf Clusters (OLC) and the Army Commendation Medal with OLC.

TACOM Assigns Clarke as Deputy Commander

COL Frank P. Clarke has assumed new duties as deputy commander, U.S. Army Tank-Automotive Command (TACOM), Warren, Mich. His most recent assignment was CO, Red River Army Depot, Texarkana, Tex.

Other key assignments have included instructor and associate professor, Department of Ordnance, U.S. Military Academy (USMA); battalion commander, 123d Maintenance Battalion, 1st Armored Division, Fort Hood, Tex.; CO, 9th Support Battalion, 198th Infantry Brigade; assistant chief of staff, Americal Division, Vietnam; staff officer, Directorate of Logistics, Joint Chiefs of Staff; and CO, Rock Island Arsenal.

COL Clarke is a 1949 U.S. Military Academy graduate and has an MS degree in engineering science from Purdue University. He has also completed the Army Command and General Staff College, Armed Forces Staff College and the National War College.

Dittamo Joins Computer Systems Command

COL Roy J. Dittamo has been named chief, Logistics Data Systems Directorate, Deputy for Management Systems, Computer Systems Command, Fort Belvoir, Va.

Until recently he was chief of the Analysis Staff, Logistics Systems Policy Committee Secretariat, DoD. Other recent assignments have included Data Systems Branch, HQ Sixth Army and ADP Coordination Branch, Military Assistance Command, Vietnam.

He is a graduate of the Army Command and General Staff College and the Armed Forces Staff College.

Marksteiner Becomes CEA Deputy Commander

COL John A. Marksteiner, until recently chief of staff, 1st Signal Brigade, Vietnam, is now deputy commander of the Combat Developments Command Communications Electronics Agency.

He began his military career in 1936 as an enlisted man, receiving a commission in the Field Artillery in 1945 and transferring to the Signal Corps in 1951. Prior to assignment in Vietnam, he was chief, Office of General Support, U.S. Army Element, Defense Communications Agency. He has served in the World War II Theater of Operations, Korea, Europe, Saudi Arabia and Alaska.

COL Marksteiner is a graduate of the Army Command and General Staff College and the Armed Forces Staff College. Among his military honors are the Legion of Merit, Bronze Star Medal with Oak Leaf Cluster (OLC), and the Army Commendation Medal with OLC.

Shade Takes Command of Deseret Test Center

COL Robert A. Shade, previously commander of the Support Command, 2d Infantry Division in Vietnam, has taken command of the Deseret Test Center, Fort Douglas, Utah. Utah.

COL Robert A. Shade

A 1950 graduate of the U.S. Military Academy (USMA), he holds MS degrees in physics from the U.S. Naval Post Graduate School and in business administration from George Washington University.

COL Shade was instructor and assistant professor of chemistry at the USMA (1961–65) before serving in Vietnam, 1965–66.

From 1966 to 1968 he was assigned to the Chemical/Biological Directorate, Office of the Assistant Chief of Staff for Force Development, DA. After attending the Industrial College of the Armed Forces, COL Shade served during 1969–71 as chief of the Chemical Branch, Officer Personnel Directorate, HQ DA.

OTSG Assigns Moore as Pharmacy Consultant

COL A. Gordon Moore, MSC, has assumed duties as pharmacy consultant, U.S. Army Surgeon General's Office, succeeding COL William J. Christopherson, MSC, upon his retirement.

COL Moore had served since 1970 as chief of Pharmacy at Walter Reed General Hospital. His assignments from 1954 through 1970 included: Fitzsimons General Hospital, Denver, Colo.; U.S. Army Hospital, Fort Ord, Calif.; instructor at the Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Tex.; pharmacy consultant, U.S. Army, Europe, and chief of Pharmacy Service, 2d General Hospital, Lanstuhl, Germany.

COL Moore has a 1952 BS degree in pharmacy from Purdue University and a 1960 MS degree in hospital pharmacy from the University of Michigan.

Dr. Leondes Selected for EAG Membership

Dr. Cornelius T. Leondes, University of California, Los Angeles, was recently named to membership on the Electronics Advisory Group (EAG), U.S. Army Electronics Command (ECOM). He was sworn in by MG Hugh F. Foster Jr., commander, ECOM and the Fort Monmouth installation.

Dr. Leondes, an educator, has bachelor's, master's and doctoral degrees from the University of Pennsylvania. He has nearly 25 years of professional, industrial and government consulting experience, including work on the nation's largest systems problems. Additionally, he has served as a consultant to all of the military services and the national space program.

A recipient of a Fulbright Research Scholar Award, Dr. Leondes is also a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and the Guggenheim Foundation.

Dr. Statler Takes Over AMRDL Directorate

Dr. Irving C. Statler

Dr. Irving C. Statler, 49, is the new director of the Ames Directorate, Army Air Mobility Research and Development Laboratory (AMRDL), Ames Research Center, Moffett Field, Calif.

Dr. Statler has served since November 1970 as the principal research scientist in aerodynamics and performance at AMRDL HQ. Earlier, while employed with the Cornell Aeronautical Laboratory, he headed the Applied Mechanics Department, and later was senior staff scientist, Aerosciences Division.

In 1945 he obtained bachelor of science degrees in aeronautical engineering and mathematics from the University of Michigan, and a PhD in aeronautics and mathematics from the California Institute of Technology in 1956.

STRATCOM Designates Stottle ACSFOR

LTC Leslie J. Stottle

LTC (COL designate) Leslie J. Stottle Jr. has been named Assistant Chief of Staff for Force Development (ACSFOR), U.S. Army Strategic Communications Command (STRATCOM), succeeding COL John D. Nacy, assigned to I Corps, Republic of Korea.

LTC Stottle began his Army career as an enlisted man and earned his commission a year later as a second lieutenant in 1952. He has a bachelor's degree in general education from the University of Nebraska, an MS degree in counseling from Shippensburg State College, and is a graduate of the Army Command and General Staff College and the Army War College.

NLABS Assigns Skoglund as Executive Officer

LTC Clifford E. Skoglund is the new executive officer of the U.S. Army Natick (Mass.) Laboratories after serving as Natick operations research systems analysis officer since February 1972.

Following five years of Marine Corps duty, he received a U.S. Army Reserve commission in 1949. He has served five Far East tours of duty, the last in 1971 as deputy chief of staff, Personnel, U.S. Army Support, Thailand. Other assignments included Quartermaster adviser with the Joint U.S. Military Advisory Group, Thailand; deputy chief, Operations Branch, Public Affairs Division and historian, General Headquarters, Supreme Commander, Allied Powers, Japan; and chief, Plans and Control Office, Quartermaster Agency, Japan.

Albertson Becomes WRAIR Executive Officer

LTC John N. Albertson Jr. has been named executive officer, Walter Reed Army Institute of Research (WRAIR), Office of the Army Surgeon General, Washington, D.C. His most recent assignment was CO, 9th Medical Laboratory, Vietnam.

Other key assignments have included bacteriologist and chief, Clinical Pathology, Valley Forge General Hospital; chief, Virology Division and Bacteriology Division, First Army Medical Laboratory, Fort Meade, Md.; chief, Medical and Biological Sciences Branch, Office of the Chief of Research and Development, Department of the Army; chief and executive officer, Microbiology Department, 9th Medical Laboratory.

personnel actions

Dr. Rosengren Joins Defense Nuclear Agency

Recently appointed as deputy director for Science and Technology, Defense Nuclear Agency (DNA), Dr. Jack W. Rosengren formerly served with the Lawrence Radiation Laboratory, University of California for 15 years, and was associate director for Special Projects since 1967.

Dr. Rosengren also served at the Lawrence Laboratory as associate director for Nuclear Design and as a project physicist for development of Polaris and Minuteman warheads. In 1952 he was appointed assistant professor of physics at Massachusetts Institute of Technology. He completed studies for his undergraduate degree and doctorate in physics at the Berkeley Campus of the University of California.

OCRD Announces New Officer Assignments

Four officers, one on temporary assignment, recently arrived for duty with the Office of the Chief of Research and Development (OCRD), Department of the Army.

COL Robert E. Parrott, USMC, is serving a temporary assignment as deputy director of Developments. As a codirector of development, he is filling a billet intended to bring the R&D efforts of the Army and U.S. Marine Corps (USMC) closer together. Permanent assignment of another USMC officer in this billet is scheduled.

COL Parrott has served numerous key assignments in the U.S. and in Vietnam. He has a BS degree in mathematics from Holy Cross College (1946) and an MS degree in personnel administration from George Washington University (1969). He has completed the Command and Staff College (Marine Corps) and the Industrial College of the Armed Forces.

His military honors include the Legion of Merit with combat "V" device, Navy Commendation Medal and Purple Heart with gold star (second award).

LTC Aubrey F. Messing (USAR) is serving a 4-year assignment as assistant for Reserve Affairs, Office, Chief of Administration, OCRD.

From 1946–49 he served as an enlisted man in the Army. He has been an active member of the Army Reserve since 1949 and earned a commission in 1952.

LTC Messing was consortium coordinator at Lakeland College, Sheboygan, Wisc. (1971–72) and a professor of chemistry at Carthage College, Kenosha, Wisc. (1963–71). Additionally, he has served as a research chemist in private industry including the government contract facilities at the Argonne (Ill.) and Oak Ridge (Tenn.) National Laboratories.

He has a 1953 BS degree in chemistry from the University of Wisconsin and a 1957 PhD in inorganic chemistry from Northwestern University. He is also a graduate of the Army Command and General Staff College and the Army War College.

MAJ Walter D. Harman is newly assigned as a staff officer with the Behavioral Sciences Division.

From 1966–69 he served as the aircraft maintenance officer, airfield operations officer and executive officer, 110th Aviation Company, Southern European Task Force. In 1965–66 he was division staff officer for the chief of staff, 1st Air Cavalry, Vietnam, and later airfield operations officer, U.S. Army Support Command, Vietnam.

MAJ Harman has a BA degree in social science from Marshall University and MA and doctoral degrees in social psychology from the University of Northern Colorado. His military honors include the Bronze star Medal, Air Medal, and the Army Commendation Medal with Oak Leaf Cluster.

MAJ Francisco Trevino Jr. is a new staff officer with the Science and Technology Division.

From 1969 to 1972 he served successive assignments at Fort Hood, Tex., as S-4, Division Artillery, 2d Armored Division; airborne sensors action officer, Modern Army Selected Systems Test Evaluation and Review; executive officer, 1st Battalion, 14th Field Artillery; and most recently deputy G-1, 2d Armored Division.

MAJ Trevino has a BS degree in geology from St. Mary's University and is a graduate of the Command and General Staff College. Military awards include Distinguished Flying Cross with OLC, Bronze Star Medal with OLC, Meritorious Service Medal and Air Medal.

SATCOM Lists 1972 Defense Satellite Communications Program Achievements

Completion of automatic data processing facilities and development of numerous earth terminals are among 1972 Defense Satellite Communications Program achievements reported by the U.S. Army Satellite Communications (SATCOM) Agency, Ft. Monmouth, N.J.

The Defense Satellite Communications System (DSCS) is designed to provide global communications service to the U.S. and allied forces throughout the world. The DSCS is designed for high-capacity broadband service, rapid extension of services into remote areas, and a high degree of survivability against physical or electronic attack.

In support of DSCS, the Army has developed 2 AN/FSC-9 terminals with 60-foot antennas, 14 AN/MSC-46s with 40-foot antennas, 13 AN/TSC-54s with 18-foot antennas, one AN/MSC-60 with a 60-foot antenna, and one AN/MSC-61 with an 18-foot antenna.

The AN/MSC-60, completed during the summer of 1972, has redundant critical components with automatic fault location and switchover to reduce the required level of operator skill. Designed to minimize the effects of electromagnetic interference, this system completed its 1,250-hour reliability test in September 1972 and is now in operational use.

Contracts for modification of the AN/MSC-46 and AN/TSC-54 are being processed and construction of 29 communications subsystems is in progress to expand the station capabilities and communication capacity when used with new satellites.

Project SHAG, a high-priority engineering project for the Air Force, was completed on schedule. Project SHAG consisted of equipping selected satellite earth terminals to provide the Air Force with a high-capacity digital data transmission system. It involved three Navy terminals in the Pacific and an Army terminal at Camp Roberts, Calif.

ENGINEER conducts a test of special satellite communications equipment built by Army Satellite Communications Agency.

The project required the fabrication, installation, testing and checkout of additional frequency conversion chains for each Navy terminal, as well as modification of their high power transmitters.

In 1972 SATCOM began installing a facility to provide test data on current and future satellite communication systems by simulating the earth terminals and the space satellites. When the installation is complete, SATCOM will be able to simulate a system of up to 22 earth stations, all operating through a single satellite.

SATCOM also completed its automatic data processing facilities in 1972. Located at Fort Monmouth, N.J., and Fort Dix, N.J., they permit running electronic tests through a satellite system in a tenth of the time that manual testing required. Their use for electronics equipment and systems testing is expanding and soon will extend into every phase of SATCOM's mission.

Ground terminals developed by the Army alone, or in conjunction with other military services, have been used under varied environmental conditions and in simulated tactical situations. Small terminals, mounted on military vehicles or carried by communications teams, were deployed in a number of field exercises during the year.

Intended for field army use under combat conditions, the terminals are operated by troops of the 235th Signal Detachment, U.S. Continental Army Command, placed in control in 1971.

The Army's Exercise Deep Furrow, performed in Greece by the 82d Division, marked a milestone in tactical satellite communication. A telecopier was connected to the terminals to transmit maps, status reports, and other graphic information to SATCOM headquarters and to the Lakehurst field station.

The facsimile data was relayed through LES-6, a communications satellite launched in 1968. Tactical terminals had previously been limited to voice and teletype transmissions.

To demonstrate extreme weather capabilities, two jeep-mounted terminals and a team-pack terminal were used in the U.S. Army Alaska Exercise Ace Band Polar Cap II. The mounted terminals were stationed at Fort Wainwright and Fort Richardson, and the teampack terminal was deployed on Arctic ice 250 miles northwest of Point Barrow.

Carried by elements of the 75th Arctic Rangers parachuted to the icecap, the terminals constituted the voice command network of the exercise. While the troops were on the icecap, the terminals were the only means of communication with command and base support elements on the mainland.

Other field exercises in which the tactical terminals provided command control communication last year were Gallant Hand, a 2d Armored Division exercise at Fort Hood, Tex., Aloud Mike and Exotic Dance V, joint Army-Air Force-Navy-Marine exercises at Fort Bragg and Camp LeJeune, N.C.; Golden Step in Germany; and Ember Dawn IV in Alaska.

Preparations were being made at year's end for use of the terminals in Aloud Oscar, an 18th Army Corps signal exercise planned for December.

Now that satellite monitoring equipment has been deployed in Germany and Hawaii, communications controllers are able to observe and regulate the use of communications satellites in synchronous orbit 22,400 miles above the earth.

By using computing methods and scheduling routines developed to complement the monitoring equipment, controllers say they can predict a satellite's behavior precisely and schedule its use with earthbound communications links.

UHF tactical satellite communications teampack terminal linked troops of the 75th Arctic Rangers on icecap with the Alaskan mainland in Exercise Ace Band Polar Cap II.

U.S. ARMY MATERIEL COMMAND

AMC BUILDING—Now nearing completion, the 13-story building will be occupied by about 2,600 AMC employes in a time-phased move expected to be completed by March 1. The building is located near the Capital Beltway at 5001 Eisenhower Ave., Alexandria, Va. 22304.

FLARE